

APR 07 2014



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



DAN WYANT
DIRECTOR

March 31, 2014

Mr. Thomas Pangborn, CEO of Savoy Exploration, Inc.
Savoy Energy L.P.
P.O. Box 1560
Traverse City, MI 49685-1560

Dear Mr. Pangborn:

This letter is in reference to your Permit to Install application for an oil and gas production facility known as the Adrian 25 (State Registration Number P0486) located at Sec. 25, Lat.: 41 55' 28.763" ' - Long.: 84 00' 55.554", Adrian Township, Lenawee County, Michigan. This application, identified as No. 23-14, has been evaluated and approved by the Air Quality Division, pursuant to the delegation of authority from the Michigan Department of Environmental Quality (DEQ).

This approval is based upon and subject to compliance with all administrative rules promulgated pursuant to Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and conditions stipulated in the enclosed supplement. Please review these conditions thoroughly so that you may take the actions necessary to ensure compliance with all of these conditions.

The engine covered by this permit is required to operate in accordance with a Preventative Maintenance/Malfunction Abatement Plan (PM / MAP). The PM / MAP Checklist, listing the items required in the plan, and the PM / MAP Checklist Guidance Document, describing each item in the checklist, are attached. The final plan is to be submitted to the Jackson District Office no later than 60 days after issuance of this permit.

To help us improve the service we provide our customers, we encourage you to complete a *Permit to Install Customer Service Survey* on the following Web page:

<https://www.surveymonkey.com/s/aqdptics>

Please contact me if you have any questions regarding this permit.

Sincerely,

Terry Wright, Senior Environmental Engineer
Chemical Process Unit
Permit Section, Air Quality Division
517-284-6806
Wrightt6@michigan.gov

Enclosures
cc/enc: Mr. Scott Miller, DEQ



PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE
APPLICATION NUMBER

23-14

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at <http://www.deq.state.mi.us/aps>. Please call the AQD at 517-373-7828 if you have not been contacted within 15 days of your application submittal.

RECEIVED

FEB 20 2014

AIR QUALITY DIV.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)			
SRN		NAICS	2 2 1 2 1 0
2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency) Savoy Energy L.P. (Adrian 25 CPF)			
3. APPLICANT ADDRESS: (Number and Street) POB 1560		MAIL CODE:	
CITY: (City, Village or Township) Traverse City	STATE: MI	ZIP CODE: 49685-1560	COUNTY: Grand Traverse
4. EQUIPMENT OR PROCESS LOCATION: (Number and Street - if different than Item 3) Sec. 25, Lat.: 41 55' 28.763" - Long.: 84 00' 55.554"			
CITY: (City, Village or Township) Adrian Township	ZIP CODE: 49221	COUNTY: Lenawee	
5. GENERAL NATURE OF BUSINESS: Oil & Natural Gas Production/Transportation			
6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.) EU00001 - CAT 398 N/G Compressor Engine (2-02-00-53). EU00002 - Dehydrator Reboiler (3-10-003-21 Trenton/Black River) Exempt Equipment A complete emission inventory of all sources can be found in the attached supporting information.			
7. REASON FOR APPLICATION: (Check all that apply.) <input checked="" type="checkbox"/> INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS <input type="checkbox"/> RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS <input type="checkbox"/> OTHER - DESCRIBE			
8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S):			
9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? <input checked="" type="checkbox"/> NOT APPLICABLE <input type="checkbox"/> PENDING APPLICATION <input type="checkbox"/> YES PENDING APPLICATION OR ROP NUMBER:			
10. AUTHORIZED EMPLOYEE: Thomas C Pangborn		TITLE: CEO of Savoy Exploration Inc.	PHONE NUMBER: (Include Area Code) (231) 941-9552
SIGNATURE:		DATE: 2/18/14	E-MAIL ADDRESS barb@savoyexp.com
11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application) Wayne Cockrum		PHONE NUMBER: (Include Area Code) 231 946 8200	
CONTACT AFFILIATION: Consultant		E-MAIL ADDRESS: wcockrum@ectinc.com	
12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
FOR DEQ USE ONLY - DO NOT WRITE BELOW			
DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: 2/20/14			
DATE PERMIT TO INSTALL APPROVED: 3/27/14		SIGNATURE:	
DATE APPLICATION / PTI VOIDED:		SIGNATURE:	
DATE APPLICATION DENIED:		SIGNATURE:	
A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL			

**MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION**

March 27, 2014

**PERMIT TO INSTALL
23-14**


ISSUED TO
Savoy Energy, L.P.

LOCATED AT
Sec. 25, Lat.: 41 55' 28.763" ' – Long.: 84 00' 55.554"
Adrian Township, Michigan

IN THE COUNTY OF
Lenawee

STATE REGISTRATION NUMBER
P0486

The Air Quality Division has approved this Permit to Install, pursuant to the delegation of authority from the Michigan Department of Environmental Quality. This permit is hereby issued in accordance with and subject to Section 5505(1) of Article II, Chapter I, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Pursuant to Air Pollution Control Rule 336.1201(1), this permit constitutes the permittee's authority to install the identified emission unit(s) in accordance with all administrative rules of the Department and the attached conditions. Operation of the emission unit(s) identified in this Permit to Install is allowed pursuant to Rule 336.1201(6).

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: February 20, 2014	
DATE PERMIT TO INSTALL APPROVED: March 27, 2014	SIGNATURE: 
DATE PERMIT VOIDED:	SIGNATURE:
DATE PERMIT REVOKED:	SIGNATURE:

PERMIT TO INSTALL
Table of Contents

Section	Page
Alphabetical Listing of Common Abbreviations / Acronyms.....	2
General Conditions.....	3
Special Conditions.....	5
Emission Unit Summary Table	5
Special Conditions for EUENGINE.....	5
Flexible Group Summary Table.....	8
Special Conditions for FGNATGASPLANT	8
Appendix A	11

Common Abbreviations / Acronyms

Common Acronyms		Pollutant / Measurement Abbreviations	
AQD	Air Quality Division	BTU	British Thermal Unit
BACT	Best Available Control Technology	°C	Degrees Celsius
CAA	Clean Air Act	CO	Carbon Monoxide
CEM	Continuous Emission Monitoring	dscf	Dry standard cubic foot
CFR	Code of Federal Regulations	dscm	Dry standard cubic meter
CO ₂ e	Carbon Dioxide Equivalent	°F	Degrees Fahrenheit
COM	Continuous Opacity Monitoring	gr	Grains
EPA	Environmental Protection Agency	Hg	Mercury
EU	Emission Unit	hr	Hour
FG	Flexible Group	H ₂ S	Hydrogen Sulfide
GACS	Gallon of Applied Coating Solids	hp	Horsepower
GC	General Condition	lb	Pound
GHGs	Greenhouse Gases	kW	Kilowatt
HAP	Hazardous Air Pollutant	m	Meter
HVLP	High Volume Low Pressure *	mg	Milligram
ID	Identification	mm	Millimeter
LAER	Lowest Achievable Emission Rate	MM	Million
MACT	Maximum Achievable Control Technology	MW	Megawatts
MAERS	Michigan Air Emissions Reporting System	ng	Nanogram
MAP	Malfunction Abatement Plan	NO _x	Oxides of Nitrogen
MDEQ	Michigan Department of Environmental Quality (Department)	PM	Particulate Matter
MSDS	Material Safety Data Sheet	PM10	PM with aerodynamic diameter ≤10 microns
NESHAP	National Emission Standard for Hazardous Air Pollutants	PM2.5	PM with aerodynamic diameter ≤ 2.5 microns
NSPS	New Source Performance Standards	pph	Pounds per hour
NSR	New Source Review	ppm	Parts per million
PS	Performance Specification	ppmv	Parts per million by volume
PSD	Prevention of Significant Deterioration	ppmw	Parts per million by weight
PTE	Permanent Total Enclosure	psia	Pounds per square inch absolute
PTI	Permit to Install	psig	Pounds per square inch gauge
RACT	Reasonably Available Control Technology	scf	Standard cubic feet
ROP	Renewable Operating Permit	sec	Seconds
SC	Special Condition	SO ₂	Sulfur Dioxide
SCR	Selective Catalytic Reduction	THC	Total Hydrocarbons
SRN	State Registration Number	tpy	Tons per year
TAC	Toxic Air Contaminant	µg	Microgram
TEQ	Toxicity Equivalence Quotient	VOC	Volatile Organic Compound
VE	Visible Emissions	yr	Year

* For High Volume Low Pressure (HVLP) applicators, the pressure measured at the HVLP gun air cap shall not exceed ten (10) pounds per square inch gauge (psig).

GENERAL CONDITIONS

1. The process or process equipment covered by this permit shall not be reconstructed, relocated, or modified, unless a Permit to Install authorizing such action is issued by the Department, except to the extent such action is exempt from the Permit to Install requirements by any applicable rule. **(R 336.1201(1))**
2. If the installation, construction, reconstruction, relocation, or modification of the equipment for which this permit has been approved has not commenced within 18 months, or has been interrupted for 18 months, this permit shall become void unless otherwise authorized by the Department. Furthermore, the permittee or the designated authorized agent shall notify the Department via the Supervisor, Permit Section, Air Quality Division, Michigan Department of Environmental Quality, P.O. Box 30260, Lansing, Michigan 48909-7760, if it is decided not to pursue the installation, construction, reconstruction, relocation, or modification of the equipment allowed by this Permit to Install. **(R 336.1201(4))**
3. If this Permit to Install is issued for a process or process equipment located at a stationary source that is not subject to the Renewable Operating Permit program requirements pursuant to R 336.1210, operation of the process or process equipment is allowed by this permit if the equipment performs in accordance with the terms and conditions of this Permit to Install. **(R 336.1201(6)(b))**
4. The Department may, after notice and opportunity for a hearing, revoke this Permit to Install if evidence indicates the process or process equipment is not performing in accordance with the terms and conditions of this permit or is violating the Department's rules or the Clean Air Act. **(R 336.1201(8), Section 5510 of Act 451, PA 1994)**
5. The terms and conditions of this Permit to Install shall apply to any person or legal entity that now or hereafter owns or operates the process or process equipment at the location authorized by this Permit to Install. If the new owner or operator submits a written request to the Department pursuant to R 336.1219 and the Department approves the request, this permit will be amended to reflect the change of ownership or operational control. The request must include all of the information required by subrules (1)(a), (b), and (c) of R 336.1219 and shall be sent to the District Supervisor, Air Quality Division, Michigan Department of Environmental Quality. **(R 336.1219)**
6. Operation of this equipment shall not result in the emission of an air contaminant which causes injurious effects to human health or safety, animal life, plant life of significant economic value, or property, or which causes unreasonable interference with the comfortable enjoyment of life and property. **(R 336.1901)**
7. The permittee shall provide notice of an abnormal condition, start-up, shutdown, or malfunction that results in emissions of a hazardous or toxic air pollutant which continue for more than one hour in excess of any applicable standard or limitation, or emissions of any air contaminant continuing for more than two hours in excess of an applicable standard or limitation, as required in Rule 912, to the Department. The notice shall be provided not later than two business days after start-up, shutdown, or discovery of the abnormal condition or malfunction. Written reports, if required, must be filed with the Department within 10 days after the start-up or shutdown occurred, within 10 days after the abnormal conditions or malfunction has been corrected, or within 30 days of discovery of the abnormal condition or malfunction, whichever is first. The written reports shall include all of the information required in Rule 912(5). **(R 336.1912)**
8. Approval of this permit does not exempt the permittee from complying with any future applicable requirements which may be promulgated under Part 55 of 1994 PA 451, as amended or the Federal Clean Air Act.
9. Approval of this permit does not obviate the necessity of obtaining such permits or approvals from other units of government as required by law.
10. Operation of this equipment may be subject to other requirements of Part 55 of 1994 PA 451, as amended and the rules promulgated thereunder.

11. Except as provided in subrules (2) and (3) or unless the special conditions of the Permit to Install include an alternate opacity limit established pursuant to subrule (4) of R 336.1301, the permittee shall not cause or permit to be discharged into the outer air from a process or process equipment a visible emission of density greater than the most stringent of the following. The grading of visible emissions shall be determined in accordance with R 336.1303. **(R 336.1301)**
 - a) A six-minute average of 20 percent opacity, except for one six-minute average per hour of not more than 27 percent opacity.
 - b) A visible emission limit specified by an applicable federal new source performance standard.
 - c) A visible emission limit specified as a condition of this Permit to Install.
12. Collected air contaminants shall be removed as necessary to maintain the equipment at the required operating efficiency. The collection and disposal of air contaminants shall be performed in a manner so as to minimize the introduction of contaminants to the outer air. Transport of collected air contaminants in Priority I and II areas requires the use of material handling methods specified in R 336.1370(2). **(R 336.1370)**
13. The Department may require the permittee to conduct acceptable performance tests, at the permittee's expense, in accordance with R 336.2001 and R 336.2003, under any of the conditions listed in R 336.2001. **(R 336.2001)**

SPECIAL CONDITIONS

EMISSION UNIT SUMMARY TABLE

The descriptions provided below are for informational purposes and do not constitute enforceable conditions.

Emission Unit ID	Emission Unit Description (Process Equipment & Control Devices)	Flexible Group ID
EUENGINE	Natural gas fired reciprocating engine.	FGNATGASPLANT

The following conditions apply to: EUENGINE

DESCRIPTION: Natural gas fired reciprocating engine.

Flexible Group ID: FGNATGASPLANT

POLLUTION CONTROL EQUIPMENT: catalytic converter

I. EMISSION LIMITS

Pollutant	Limit	Time Period / Operating Scenario	Equipment	Testing / Monitoring Method	Underlying Applicable Requirements
1. NO _x	6 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE	SC VI.5 and Appendix A	R 336.1205 40 CFR 52.21(c) & (d)
2. CO	12 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE	SC VI.6 and Appendix A	R 336.1205 40 CFR 52.21(d)

II. MATERIAL LIMITS

NA

III. PROCESS/OPERATIONAL RESTRICTIONS

1. No later than 60 days after issuance of this permit, the permittee shall submit to the AQD District Supervisor, for review and approval, a preventative maintenance / malfunction abatement plan (PM / MAP) for EUENGINE. After approval of the PM / MAP by the AQD District Supervisor, the permittee shall not operate EUENGINE unless the PM / MAP, or an alternate plan approved by the AQD District Supervisor, is implemented and maintained. The plan shall incorporate procedures recommended by the equipment manufacturer as well as incorporating standard industry practices. At a minimum the plan shall include:
 - a) Identification of the equipment and, if applicable, air-cleaning device and the supervisory personnel responsible for overseeing the inspection, maintenance, and repair
 - b) Description of the items or conditions to be inspected and frequency of the inspections or repairs

- c) Identification of the equipment and, if applicable, air-cleaning device, operating parameters that shall be monitored to detect a malfunction or failure, the normal operating range of these parameters and a description of the method of monitoring or surveillance procedures
- d) Identification of the major replacement parts that shall be maintained in inventory for quick replacement
- e) A description of the corrective procedures or operational changes that shall be taken in the event of a malfunction or failure to achieve compliance with the applicable emission limits

If the plan fails to address or inadequately addresses an event that meets the characteristics of a malfunction at the time the plan is initially developed, the owner or operator shall revise the plan within 45 days after such an event occurs and submit the revised plan for approval to the AQD District Supervisor. Should the AQD determine the PM / MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. (R 336.1205, R 336.1702(a), R 336.1910, R 336.1911, R 336.1912, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

- 2. The permittee shall not operate any engine equipped with an add-on control device for more than 200 hours per engine per year without that control device consistent with the PM / MAP (pursuant to SC III.1). The 200 hours shall include times after an engine change-out occurs and general maintenance performed as allowed by the PM / MAP. The hours per year limit is based on a 12-month rolling time period as determined at the end of each calendar month. (R 336.1205, R 336.1702(a), R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))
- 3. The permittee shall not operate any engine that contains an add-on control device unless that device is installed, maintained, and operated in a satisfactory manner, except as specified in SC III.2. Satisfactory operation includes performing the manufacturer's recommended maintenance on the control device and operating in conjunction with the PM / MAP specified in SC III.1. (R 336.1205, R 336.1702(a), R 336.1910, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

IV. DESIGN/EQUIPMENT PARAMETERS

- 1. The permittee shall install, calibrate, maintain and operate in a satisfactory manner a device to monitor the natural gas usage for EUENGINE on a continuous basis. (R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

V. TESTING/SAMPLING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

- 1. Upon request by the AQD District Supervisor, the permittee shall verify NO_x and CO emission factors used to calculate emissions from EUENGINE, by testing at owner's expense, in accordance with Department requirements. If a test has been conducted, any resulting increase in an emission factor shall be implemented to calculate NO_x and CO. No less than 60 days prior to testing, the permittee shall submit a complete test plan to the AQD. The AQD must approve the final plan prior to testing. Verification of emission rates includes the submittal of a complete report of the test results to the AQD within 60 days following the last date of the test. (R 336.1205, R 336.2001, R 336.2003, R 336.2004, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

VI. MONITORING/RECORDKEEPING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

- 1. The permittee shall complete all required calculations in a format acceptable to the AQD District Supervisor and make them available by the last day of the calendar month, for the previous calendar month, unless otherwise specified in any monitoring/recordkeeping special condition. (R 336.1205, R 336.1702(a))
- 2. The permittee shall monitor in a satisfactory manner, the natural gas usage for EUENGINE on a continuous basis. (R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

3. The permittee shall maintain a log of all maintenance activities conducted according to the PM / MAP (pursuant to SC III.1). The permittee shall keep this log on file at a location approved by the AQD District Supervisor and make it available to the Department upon request. **(R 336.1205, R 336.1702(a), R 336.1911, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
4. The permittee shall keep, in a satisfactory manner, for any engine equipped with an add-on control device, monthly and 12-month rolling time period records of the hours that the engine is operated without the control device. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.1702(a), R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
5. The permittee shall keep, in a satisfactory manner, monthly and 12-month rolling time period NO_x emission calculation records for EUENGINE, as required by SC I.1 and Appendix A. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
6. The permittee shall keep, in a satisfactory manner, monthly and 12-month rolling time period CO emission calculation records for EUENGINE, as required by SC I.2 and Appendix A. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205)**
7. The permittee shall keep, in a satisfactory manner, monthly fuel use records for EUENGINE, as required by SC VI.2. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**

VII. REPORTING

1. Except as provided in R 336.1285, if the engine is replaced with an equivalent-emitting or lower-emitting engine, the permittee shall notify the AQD District Supervisor of such change-out and submit acceptable emissions data to show that the alternate engine is equivalent-emitting or lower-emitting. The data shall be submitted within 30-days of the engine change out. **(R 336.1205, R 336.1702(a), R 336.1911, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**

VIII. STACK/VENT RESTRICTIONS

The exhaust gases from the stacks listed in the table below shall be discharged unobstructed vertically upwards to the ambient air unless otherwise noted:

Stack & Vent ID	Maximum Exhaust Diameter/ Dimensions (inches)	Minimum Height Above Ground (feet)	Underlying Applicable Requirements
1. SVENGINE	8	36	R 336.1225 40 CFR 52.21 (c) & (d)

IX. OTHER REQUIREMENTS

1. The permittee shall comply with all applicable provisions of the National Emission Standards for Hazardous Air Pollutants, as specified in 40 CFR, Part 63, Subpart A and Subpart ZZZZ, for Stationary Reciprocating Internal Combustion Engines. **(40 CFR, Part 63, Subparts A and ZZZZ)**

FLEXIBLE GROUP SUMMARY TABLE

The descriptions provided below are for informational purposes and do not constitute enforceable conditions.

Flexible Group ID	Flexible Group Description	Associated Emission Unit IDs
FGNATGASPLANT	All process equipment at the facility for processing natural gas.	EUENGINE

The following conditions apply Source-Wide to: FGNATGASPLANT

DESCRIPTION: All process equipment at the facility for processing natural gas.

Emission Units: EUENGINE

POLLUTION CONTROL EQUIPMENT: vapor recovery unit, flare

I. EMISSION LIMITS

NA

II. MATERIAL LIMITS

NA

III. PROCESS/OPERATIONAL RESTRICTIONS

1. The permittee shall not burn any sour natural gas in FGNATGASPLANT. Sour gas is defined as any gas containing more than 1 grain of hydrogen sulfide or more than 10 grains of total sulfur per 100 standard cubic feet. **(R 336.1205(3), R 336.1119)**
2. The permittee shall demonstrate initial and continuous compliance with the federal Standards of Performance for New Stationary Sources as specified in 40 CFR Part 60 Subparts A and OOOO for all of the following:
 - a. pneumatic controllers
 - b. all equipment except compressors
 - c. equipment leaks**(40 CFR 60.5410, 60.5411, 60.5415)**
3. The permittee shall comply with the bleed rate standards for pneumatic controllers specified in 40 CFR 60.5390. **(40 CFR 60.5390)**
4. The permittee shall comply with the equipment leak standards specified in 40 CFR 60.5400. **(40 CFR 60.5400)**
5. The permittee shall comply with all provisions of the National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 63, Subpart HH, as they apply to the glycol dehydrator. **(40 CFR Part 63, Subpart HH)**

IV. DESIGN/EQUIPMENT PARAMETERS

1. The permittee shall tag all pneumatic controllers with the information identified in 40 CFR 60.5390(b)(2). **(40 CFR 60.5390(b)(2))**
2. The permittee shall equip and maintain each 400 barrel liquid storage vessel at the facility with a cover meeting the requirements in 40 CFR 60.5411(b). **(40 CFR 60.5365(e)(1))**
3. The permittee shall not store any liquid in a storage vessel unless the vapors from each storage vessel are routed to a process via a closed vent system meeting the requirements of 40 CFR 60.5411(c). **(40 CFR 60.5365(e)(2))**

V. TESTING/SAMPLING

NA

VI. MONITORING/RECORDKEEPING

Records shall be maintained on file for a period of five years. **(R 336.1201(3))**

1. For each storage vessel at the facility, the permittee shall maintain records documenting compliance with the cover requirements in 40 CFR 60.5411(b) and the closed vent system requirements in 60.5411(c). **(40 CFR 60.5365(e)(3))**
2. In the event of removal of apparatus that recovers and routes vapor from each 400 barrel storage vessel to a process, the permittee shall determine the VOC potential to emit from each 400 barrel storage vessel within 30 days of such removal. **(40 CFR 60.5365(e)(4))**
3. If the glycol dehydrator meets the exemption criteria in 40 CFR 63.764(e)(1)(i) for glycol dehydrators with actual annual average flow rate of natural gas less than 85,000 cubic meters per day, the actual flow rate of natural gas shall be determined using either of the procedures below:
 - a) The permittee shall install and operate a monitoring instrument that directly measures natural gas flow rate to the glycol dehydration unit with an accuracy of plus or minus 2 percent or better. The permittee shall convert annual natural gas flow rate to a daily average by dividing the annual flow rate by the number of days per year the glycol dehydration unit processed natural gas. **(40 CFR 63.772(b)(1)(i))**
 - b) The permittee shall document, to the AQD District Supervisor's satisfaction, that the actual annual average natural gas flow rate to the glycol dehydration unit is less than 85,000 cubic meters per day. **(40 CFR 63.772(b)(1)(ii))**

As an alternative, if the glycol dehydrator meets the exemption criteria in 40 CFR 63.764(e)(1)(ii) for glycol dehydrators with actual average benzene emissions less than 0.90 megagram per year, the emissions shall be determined either uncontrolled, or with federally enforceable controls in place and using either of the procedures below:

- c) The permittee shall determine actual average benzene emissions using the model GRI-GLYCalc™, Version 3.0 or higher, and the procedures presented in the associated GRI-GLYCalc™ Technical Reference Manual. Inputs to the model shall be representative of actual operating conditions of the glycol dehydration unit and may be determined using the procedures documented in the Gas Research Institute (GRI) report entitled "Atmospheric Rich/Lean Method for Determining Glycol Dehydrator Emissions" (GRI-95/0368.1). **(40 CFR 63.772(b)(2)(i))**
- d) The permittee shall determine an average mass rate of benzene emissions in kilograms per hour through direct measurement using the methods in 40 CFR 63.772(a)(1)(i) or (ii), or an alternative method according to 40 CFR 63.7(f). Annual emissions in kilograms per year shall be determined by multiplying the mass rate by the number of hours the unit is operated per year. This result shall be converted to megagrams per year. **(40 CFR 63.772(b)(2)(ii))**

4. If the glycol dehydrator complies with the exemption criteria in 40 CFR 63.764(e)(1)(i) for glycol dehydrators with actual annual average flow rate of natural gas less than 85,000 cubic meters per day, the permittee shall keep records of the actual annual average natural gas throughput (in terms of natural gas flow rate to the glycol dehydration unit per day) as determined in accordance with SC VI.1. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request.

As an alternative, if the glycol dehydrator complies with the exemption criteria in 40 CFR 63.764(e)(1)(ii) for glycol dehydrators with actual average benzene emissions less than 0.90 megagram per year, the permittee shall keep records of the actual average benzene emissions (in terms of benzene emissions per year) as determined in accordance with SC VI.1. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request.
(40 CFR 63.774(d)(1))

VII. REPORTING

1. The permittee shall submit all applicable notifications and reports required by 40 CFR 63.775 by the dates specified in 40 CFR 63.775. **(40 CFR 63.775)**
2. For pneumatic controllers, the permittee shall perform all the notification, recordkeeping and reporting required by 40 CFR 60.5420. **(40 CFR 60.5390(f))**

VIII. STACK/VENT RESTRICTIONS

NA

IX. OTHER REQUIREMENTS

1. The permittee shall comply with all applicable provisions of the federal Standards of Performance for New Stationary Sources as specified in 40 CFR Part 60 Subparts A and OOOO. **(40 CFR Part 60 Subparts A & OOOO)**
2. The permittee shall demonstrate initial compliance with all applicable provisions of the federal Standards of Performance for New Stationary Sources as specified in 40 CFR Part 60 Subparts A and OOOO as they apply to pneumatic controllers. **(40 CFR 60.5410(d))**
3. The permittee shall demonstrate initial compliance with all applicable provisions of the federal Standards of Performance for New Stationary Sources as specified in 40 CFR Part 60 Subparts A and OOOO as they apply to covers and closed vent systems routing materials from storage vessels. **(40 CFR 60.5411(b) and (c))**
4. The permittee shall demonstrate continuous compliance with all applicable provisions of the federal Standards of Performance for New Stationary Sources as specified in 40 CFR Part 60 Subparts A and OOOO as they apply to pneumatic controllers. **(40 CFR 60.5415(d))**

APPENDIX A
Procedures for Calculating CO and NOx Emissions

The permittee shall demonstrate compliance with the CO and NOx emission limits by keeping track of all fuel usage for EUENGINE and multiplying that fuel usage by an equipment-specific emission factor. The emission factors are typically expressed as the mass of pollutant per unit of fuel.

EUENGINE:

The permittee shall use emission factors from vendor data or from source specific testing (stack testing), as available for EUENGINE. This also applies to engine(s) from engine change-out(s). If emission factors from other sources are used, the permittee shall obtain the approval of the AQD District Supervisor before using the emission factors to calculate emissions.

The permittee shall document the source of each emission factor used in the calculations.

**Preventative Maintenance / Malfunction Abatement Plan (PM / MAP)
Content Checklist for Engines Required to Submit a PM / MAP**

PM / MAP Content		Location	
		Page	Section / Table
1	Contact Person		
Engines			
2	Engine Identification: Include the engine make / model and type of engine (i.e. rich or lean burn). Identify engines with add on control and AFRC. If add on control is present, identify type of control.		
3	Engine Operating Variables To Be Monitored. Include a copy of the normal engine maintenance log.		
4	Corrective procedures or operational changes that will be taken in the event of a malfunction.		
5	Major parts replacement inventory for engines.		
Add-On Controls			
6	Catalytic Converter operating variables to be monitored. Include the method and frequency of monitoring these variables; provide the normal operating range of these variables.		
7	Corrective actions to be taken in event of malfunction of the catalytic converter.		
8	AFRC O ₂ Sensor replacement schedule or operating variables to be monitored		
9	Corrective actions to be taken in event of malfunction of the AFRC		
10	Emission testing utilizing portable analyzer		
11	Scheduled maintenance of control equipment		
12	Major parts replacement inventory for add on control.		
13	Identify supervisory personnel responsible for overseeing inspection, maintenance and repair of add on controls.		
14	Recordkeeping and retention of records.		
15	Updates of PM / MAP as necessary.		

**Guidance Document For
Preventative Maintenance / Malfunction Abatement Plan (PM / MAP) Checklist**

1. **Contact Person:** Include the name, title, telephone number (extension if applicable) and e-mail address for the person that may be contacted with questions regarding this Preventative Maintenance / Malfunction Abatement Plan (PM / MAP) with the transmittal letter accompanying the PM / MAP rather than within the body of the PM / MAP.

Engines

2. **Engine Identification:** For each engine at the facility, list the engine manufacturer, model and type of engine (rich burn or lean burn) and the type of add-on control equipment used (oxidation catalyst, three-way catalyst), if any. Also, identify each engine with an air to fuel ratio controller (AFRC).
3. **Engine operating variables to be monitored:** Provide the normal engine maintenance log.
4. **Corrective procedures in the event of an engine malfunction:** Provide a brief summary of the procedures that will take place in the event of an engine malfunction. A malfunction is defined in Rule 113(d) of the State of Michigan Air Pollution Control Rules which states, in part, 'any sudden, infrequent and not reasonable preventable failure of the equipment to operate in a normal or usual manner. Failures caused in part by poor maintenance or careless operations are not malfunctions.'
5. **Major parts replacement inventory:** Provide a list of major replacement parts that shall be maintained in inventory for quick replacement. If no replacement parts are kept on site provide a statement that no parts shall be kept.

Add-On Controls

6. **Catalytic converter operating variables to be monitored:** Provide the following:
 - a. A list of variables that will be monitored to measure catalytic converter performance including the catalytic converter inlet and outlet temperature, pressure differential across the catalytic converter, and any other relevant catalytic converter variables that are monitored.
 - b. The normal operating range that has been developed for each variable; acceptable ranges shall include documentation as to how the range was determined (i.e. manufacturer's recommendations or determined in the field with documentation or testing).
 - c. The method of monitoring the variables, and
 - d. The frequency of monitoring the variables.
7. **Corrective procedures in the event of a malfunction of the catalytic converter:** Malfunction is defined in number four above. Provide information on what steps shall be taken when a variable is out of range. This could include monitoring of emissions or cleaning and/or replacement of the catalytic converter.
8. **AFRC O₂ sensor replacement schedule or operating variables to be monitored:** Chose either (a) or (b).
 - a. O₂ sensor replacement interval or sensor life detector
 - b. If monitoring, provide:
 - i. A list of variables monitored to measure AFRC performance (i.e. millivolt output, O₂, and/or any other relevant AFRC variables that are monitored).
 - ii. The normal operating range that has been developed for each variable; acceptable ranges shall include documentation as to how the range was determined (i.e. manufacturer's recommendations or determined in the field with documentation or testing).
 - iii. The method of monitoring the variables.
 - iv. The frequency of monitoring the variables.

9. Corrective procedures in the event of a malfunction of the AFRC: Malfunction is defined in number 4 above. If choosing monitoring in paragraph 8.b above, provide information on what steps shall be taken when a variable is out of range.
10. Emission checks: Describe when a portable analyzer would be used and how it will be used.
 - a. Calibration of the analyzer will be conducted as required by manufacturer's specifications. Records shall be kept on file and made available to the Air Quality Division upon request.
 - b. Checks for both CO and NO_x.
 - c. Checks to be used to:
 - i. Check performance if monitored parameter is out of normal range, e.g. low inlet temperature (an engine specific minimum inlet temperature could then be established).
 - ii. When vendor cleaned catalyst is installed. This check will normally occur in the 12-18 month window as specified for routine cleaning.
 - d. Companies may choose to perform any of following the three valid methods:
 - i. Inlet and outlet checks and estimate destruction efficiency.
 - ii. Outlet testing and check for g/hp-hr compared to levels used for permitting.
 - iii. Outlet testing and use the uncontrolled vendor data to establish destruction efficiency.
11. Scheduled maintenance: Describe the scheduled cleaning and/or replacement of the catalytic converter.
 - a. Frequency of catalytic converter inspection and field catalyst media cleaning (vacuum catalyst face): Follow vendor recommendations, typically 12-18 months unless parameters (pressure drop, temperature deviations, etc) indicate otherwise.
 - b. Catalyst media removal and wash in chemical solution by manufacturer (if catalyst media does not respond to field cleaning). A replacement catalyst media will be used during the cleaning process.
 - c. Catalytic converter gasket replacement: Follow vendor recommendations, typically 12-18 months when catalyst is serviced.
 - d. Replace catalyst media if not functioning properly after vendor cleaning, or in lieu of vendor cleaning.
12. Major parts replacement inventory: Provide a list of major replacement parts that shall be maintained in inventory for quick replacement. If no replacement parts are kept on site provide a statement that no parts shall be kept.
13. Supervisory personnel responsible for maintenance of the control equipment: Include the contact information. This person or position can be a company employee or contractor and may or may not be the same person / position listed in number one above.
14. Retention of records: Records shall be kept on file and retained as described in the permit.
15. Updates of PM / MAP: Any updates to the plan shall be submitted to the AQD District Supervisor for written approval as required in the permit (the Department of Environmental Quality recommends the PM / MAP be reviewed annually).



PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE
APPLICATION NUMBER

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at <http://www.deq.state.mi.us/aps>. Please call the AQD at 517-373-7023 if you have not been contacted within 15 days of your application submittal.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)			
SRN		NAICS	2 2 1 2 1 0
2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency) Savoy Energy L.P. (Adrian 25 CPF)			
3. APPLICANT ADDRESS: (Number and Street) POB 1560		MAIL CODE:	
CITY: (City, Village or Township) Traverse City	STATE: MI	ZIP CODE: 49685-1560	COUNTY: Grand Traverse
4. EQUIPMENT OR PROCESS LOCATION: (Number and Street - if different than Item 3) Sec. 25, Lat.: 41 55' 28.763" - Long.: 84 00' 55.554"			
CITY: (City, Village or Township) Adrian Township		ZIP CODE: 49221	COUNTY: Lenawee
5. GENERAL NATURE OF BUSINESS: Oil & Natural Gas Production/Transportation			
6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.) EU00001 - CAT 398 N/G Compressor Engine (2-02-00-53). EU00002 - Dehydrator Reboiler (3-10-003-21 Trenton/Black River) Exempt Equipment A complete emission inventory of all sources can be found in the attached supporting information.			
7. REASON FOR APPLICATION: (Check all that apply.) <input checked="" type="checkbox"/> INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS <input type="checkbox"/> RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS <input type="checkbox"/> OTHER - DESCRIBE			
8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S):			
9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? <input checked="" type="checkbox"/> NOT APPLICABLE <input type="checkbox"/> PENDING APPLICATION <input type="checkbox"/> YES PENDING APPLICATION OR ROP NUMBER:			
10. AUTHORIZED EMPLOYEE: Thomas C. Pangborn		TITLE: CEO of Savoy Exploration Inc.	PHONE NUMBER: (Include Area Code) (231) 941-9552
SIGNATURE:		DATE: 2/19/14	E-MAIL ADDRESS barb@savoyexp.com
11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application) Wayne Cockrum		PHONE NUMBER: (Include Area Code) 231 946 8200	
CONTACT AFFILIATION: Consultant		E-MAIL ADDRESS: wcockrum@ectinc.com	
12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
FOR DEQ USE ONLY - DO NOT WRITE BELOW			
DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203:			
DATE PERMIT TO INSTALL APPROVED:		SIGNATURE:	
DATE APPLICATION / PTI VOIDED:		SIGNATURE:	
DATE APPLICATION DENIED:		SIGNATURE:	
A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL			

PERMIT TO INSTALL
SAVOY ENERGY
ADRIAN 25 CPF
OIL & GAS PRODUCTION FACILITY
SUPPORTING INFORMATION

Table of Contents

1.0	Process Description
1.1	General
1.2	Natural Gas Compressor Engine
2.0	Emissions
2.1	Engine Emissions
2.2	Dehydrator Reboiler
2.3	Dehydrator Burner
2.4	Line heaters
2.5	Heater Treaters
2.6	Oil tanks
2.7	Truck Loadouts
2.8	Emergency Flare
2.9	Fugitive Emissions
3.0	Regulatory Discussion
3.1	State and Federal Regulations
3.2	Title V Renewable Operating Permit Applicability
4.0	Control Technology Analysis
4.1	Compressor Engine - CAT 398
4.2	Dehydrator Reboiler
4.3	Heaters/Burners
4.4	Crude Oil Storage Tanks
5.0	Stack Parameters
6.0	Emission Calculations
6.1	Calculation of Potential Emissions from Natural Gas Engine
6.1.1	CAT 398
6.2	Calculation of Potential Emissions from Glycol Dehydrator Reboiler (GlyCalc)
6.3	Calculation of Potential Emissions Dehydrator Burner, Line Heaters, Heater Treaters, & Emergency Flare
6.4	Fugitive Emissions

Tables

<u>Appendix</u>	<u>Title</u>
A	Site Plan (Figure 1)
B	Emission Data, (Vendor) Equipment Drawings
C	MDEQ, Air Quality Division Fact Sheet
D	GLYCalc Report
E	Variance to Rule 225

ADRIAN 25 CENTRAL PROCESSING FACILITY (CPF)

SUPPORTING INFORMATION

INTRODUCTION

Savoy Energy is requesting a Permit to Install for the Adrian 25 CPF. The requested permit would allow the operation of one natural gas fired engine and one glycol dehydrator reboiler. Emissions for the engine and reboiler are depicted within this supporting information.

As necessary to determine Title V, Renewable Operating Permit (ROP) applicability, emissions from the sources were tallied and combined with the existing permitted sources and also the existing exempt sources. Total NOx emissions from all sources do not exceed the Title V threshold of 100 tons. Total emissions for the other criteria pollutants and hazardous air pollutants also remain below the ROP threshold. See Table 2.6 for a complete emission inventory.

Subject facility is located in SW/NW/NE Section 25, T6S-R3E, Adrian Township, Lenawee County, Michigan. Lat.: 41° 55' 28.763" – Long.: 84° 00' 55.554"

1.0 PROCESS DESCRIPTION

1.1 General

Natural gas and oil from wells is passed through field separators, heaters, a dehydrator a compression system and a refrigeration unit at the CPF to remove hydrocarbon condensate, water, control gas pressure necessary for further pipeline transport, and remove liquid petroleum under pressure.

The emission sources in the process will require one compressor engine, a glycol dehydrator reboiler, a dehydrator burner, six line heaters, six heater-treaters, an emergency flare, four 400 barrel oil tanks and fugitive emissions associated with loadouts, an LP pressure tank and pipe fittings. Each emission source will be detailed in this process description.

1.2 Natural Gas Engine – EU00001 (SCC Number: 2-02-002-53)

The primary emission source at subject oil and gas production facility is the natural gas-fired engine. The engine is used to power compressors to facilitate further pipeline transportation.

Subject engine is fueled by non-processed natural gas.

The natural gas-fired engine required at site is one, 4-stroke, 600 HP, CAT 398 NA, compressor engine. The engine is designed, and will operate 24 hours per day, 365 days per year. Engine emission specifications are listed in Appendix B.

1.3 Gas Dehydration – EU00002 (SCC 3-10-003-23 and SCC 3-10-002-27)

Prior to entering the natural gas collection pipeline (return line), the natural gas must be stripped of unwanted liquids, and dried or dehydrated to dew point levels set forth by the central processing

facility. This process is accomplished by utilizing a packaged glycol dehydration unit. Regeneration of the glycol solution used for dehydrating the natural gas can, however, release volatile organic compounds.

In addition to the gas stripping function provided by the glycol dehydration unit, tri-ethylene glycol associated with the dehydration process must be heated in order to facilitate moisture removal. This is being accomplished at subject site with a 250,000 BTU/hr gas-fired burner, necessitating additional emission evaluation associated with the burner. Uncontrolled Potential to Emit (PTE) calculations for the glycol burner and reboiler are provided in Tables 2.3 and 2.4 of this PTI application, as is necessary for Title V consideration, or in the event MDEQ, Air Quality Division requires subject emissions be included in this permit.

2.0 EMISSIONS

2.1 Engine Emissions

The primary pollutants of concern from natural gas fired engines are the oxides of nitrogen (NO_x), Volatile Organic Compounds (VOCs), and Carbon Monoxide (CO) which readily forms in the high-temperature, pressure, and excess air environment found in gas firing engine processes. Natural gas fueled engines, particularly reciprocating engines emit significantly more of these pollutants than do external combustion burners.

Major emission variables are also associated with natural gas-fired engines and can include air/fuel ratio, engine load (defined as the ratio of the operating horsepower to rated horsepower), intake manifold air temperature, and absolute humidity. NO_x emissions along with all the other regulated criteria compounds for the engine are tabulated in Tables 2.1 and 2.2.

- Compressor Engine EU - 00001 - Caterpillar 398 NA 600 hp

UNCONTROLLED

NO_x – 12.42 lb/hr, 54.4 tons/yr *

CO – 13.08 lb/hr, 57.3 tons/yr *

HC – 2.12 lb/hr, 9.3 tons/yr *

CONTROLLED

NO_x – 1.24 lb/hr, 5.44 tons/yr **

CO – 2.62 lb/hr, 11.48 tons/yr **

HC – 1.06 lb/hr, 4.64 tons/yr **

* Note: Emission factors supplied by Vendor (attached).

** Note: Control efficiency supplied by MDEQ Emission Calculation Fact Sheet #9845.

NO_x: 90% Reduction

CO: 80% Reduction

VOC: 50% Reduction

2.2 Glycol Dehydrator Reboiler EU00002 (1)

VOCs emissions from the dehydrator reboiler are based on a GLYCalc4 report dated 11/25/13 (Appendix D).

2.3 Glycol Dehydrator Burner (1)

Fuel Gas volume (250,000 BTU/HR) / (1,000 btu/ft³) = 250 ft³/hr
(250 ft³/hr) / (1,000,000 ft³) x 140 NOx = 0.035 lbs/hr or 308 lbs/yr NOx

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.4 Line heaters (9)

Fuel Gas volume (500,000 BTU/HR) / (1,000 btu/ft³) = 500 ft³/hr
(500 ft³/hr) / (1,000,000 ft³) x 140 NOx = 0.07 lbs/hr or 616 lbs/yr NOx

Total all six heaters: 5,544 lbs/yr NOx

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.5 Heater Treaters (9)

Fuel Gas volume (750,000 BTU/HR) / (1,000 btu/ft³) = 750 ft³/hr
(750 ft³/hr) / (1,000,000 ft³) x 140 NOx = 0.105 lbs/hr or 919.8 lbs/yr NOx

Total all six heaters: 8,278 lbs/yr NOx

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.6 Oil Tanks - 400 Barrels (2)

Uncontrolled Fixed Roof Breathing Loss

Storage Capacity 400 bbl x 2 tanks = 800 bbls or 33,600 gallons crude.
VOCs = 3.6E1 LB/KGAL-Yr Crude Oil (Storage Capacity)
VOCs = 36 x 33,600 gallons ÷ 1000 = 1,209.5 LB

Controlled Fixed Roof Breathing Loss

Storage Capacity 400 bbl x 2 tanks = 800 bbls or 33,600 gallons crude.
VOCs = 3.6E1 LB/KGAL-Yr Crude Oil (Storage Capacity)
VOCs = 36 x 33,600 gallons ÷ 1000 = 1,209.5 LBS
Controlled VOCs = 95% reduction or 60.48 LBS

Uncontrolled Fixed Roof Working Loss

Storage Capacity 400 bbl x 2 tanks = 800 bbls or 33,600 gallons crude.
VOCs = 1.1E0 LB/E3 Gal Crude Oil (Annual Throughput)
VOCs = 1.1 x 10.731 mm gallons/yr ÷ 1000 = 10,731 LB

Controlled Fixed Roof Working Loss

Storage Capacity 400 bbl x 2 tanks = 800 bbls or 33,600 gallons crude.
VOCs = 1.1E0 LB/E3 Gal Crude Oil (Annual Throughput)
VOCs = 1.1 x 10.731 mm gallons/yr ÷ 1000 = 10,731 LB

Controlled VOCs = 95% reduction or 537 LBS

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.7 Truck Loadout

Crude Oil Throughput: 255,500 bbls/yr or 10.731 mmgallons/yr
VOCs = 2.0E0 LB/E3 Gallons Crude Oil
VOCs = 21,462 lbs/yr or 10.731 tons/yr

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.8 Emergency Flare

Throughput from oil tanks: 26 ft³/hr

(26 ft³/hr) / (1,000,000 ft³) x 140 NOx = 0.004 lbs/hr or 32 lbs/yr NOx

2.9 Fugitive Emissions

Emissions that are not, and cannot be contained or collected, and emitted through a stack or vent are defined as fugitive. Examples of fugitive emission sources would be: flanges, connectors, valves, pumps, regulators etc. associated with gas compression and the natural gas flow process at subject site. Although the number of fugitive emission sources have not been counted at subject site it can be assumed, based on counts at similar sites, that the number of fugitive sources at subject site is significantly below, or <100 valves, <100 connectors, and <100 flanges. Based on these counts fugitive emissions will be less than the following:

Equipment	E-Factor: lb/hr/source	Count	VOC Emissions lbs/hr	VOC Emissions lbs/yr
Flange	0.0000924*	<100	<0.00924	<80.94
Valve	0.0000286*	<100	<0.00286	<25.05
Connectors	0.0000924*	<100	<0.00924	<80.94
Totals			<0.02134	<186.93

*Emission Factors from EPA-453/R-95-017

Cumulative emissions from all sources including Fugitive are depicted in Table 2.6

3.0 REGULATORY DISCUSSION

3.1 State and Federal Regulations

Compressor Engine CAT 398 NA EU00001

State Exemptions

The CAT 398 NA compressor engine has a maximum heat input less than 10,000,000 BTU per hour, which qualifies it for exemption under Michigan Air Quality Division (AQD) Rule 336.1285(g). AQD R336.1278 however, requires a permit if actual emissions from any activity exceeds significant levels (40 tons/year NO_x or 100 tons/year CO). A permit to install is required for subject compressor engine, but is not subject to major source fees. The allowable emissions may be determined as necessary by dispersion modeling of the ambient impact, or as directed by AQD staff.

40 CFR 60 - Subpart JJJJ

Cat 398 NA engine is not subject to NSPS Subpart JJJJ. Subject engine was constructed prior to June 1, 2007. See rule 60.4230(a)(4).

40 CFR 60 - Subpart KKK

The Adrian 25 CPF is not subject to Subpart KKK. Facilities constructed after August 23, 2011 are not subject to the rule.

40 CFR 60 – Subpart OOOO

To be determined..

NESHAP, Subpart ZZZZ

Cat 398 NA engine is subject to NESHAP Subpart ZZZZ, for HAP area sources and will be subject to emission limitations beginning October 19, 2013. (See Rule 63.6595). The CAT 398 engine will be equipped with a catalytic converter to comply with subject regulation.

AQD, R336.1702

CAT 398 NA engine is subject to Rule 336.1702 - Emissions are based on a determination of BACT. This engine meets BACT requirements based on insignificant emissions as described above.

AQD, R336.1224

Cat 398 NA engine is subject to Rule 336.1224 (2)(c) - Best Available Control Technology for Toxics (T-BACT) is not warranted however when in compliance with Best Available Control Technology (BACT). BACT is acceptable when the emissions levels are very low or insignificant and the cost to remove these emissions is very high, therefore the CAT 398 NA is in compliance with BACT.

AQD, R336.1225

CAT 398 NA engine is not subject to Rule 336.1225 if the associated stack is greater than 1.5 times the building height (MDEQ, Air Quality Division Variance, effective date 1/21/10 ((Appendix E)). The stack at this site will be constructed at a height greater than 1.5 times the building height.

Dehydrator Burner

The Glycol reboiler burner has maximum heat inputs less than 50,000,000 BTU per hour, which qualifies it for exemption under Michigan Air Quality Division (AQD) Rule 336.1282(b)(i). A **permit to install is not required** for subject burner but is included in this permit application only to maintain an accurate site emission inventory.

Dehydrator Reboiler Vent EU00002

There are no exemptions that reference glycol dehydrators associated with oil production from the Trenton Formation. Benzene emissions from the reboiler exceed the Rule 336.1290 exemption for carcinogens. A **permit to install is required** for reboiler vent.

AQD, R336.1702

Rule 702. A person who is responsible for any new source of volatile organic compound emissions shall not cause or allow the emission of volatile organic compound emissions from the new source in excess of the lowest maximum allowable emission rate of the following:

- (a) The maximum allowable emission rate listed by the department on its own initiative or based upon the application of the best available control technology.
- (b) The maximum allowable emission rate specified by a new source performance standard promulgated by the United States environmental protection agency under authority enacted by title I, part A, section 111 of the clean air act, as amended, 42 U.S.C. §7413.
- (c) The maximum allowable emission rate specified as a condition of a permit to install or a permit to operate.
- (d) The maximum allowable emission rate specified in part 6 of these rules which would otherwise be applicable to the new source except for the date that the process or process equipment was placed into operation or for which an application for a permit to install, under the provisions of part 2 of these rules, was made to the department. If the part 6 allowable emission rate provides for a future compliance date, then the future compliance date shall also be applicable to a new source pursuant to this subdivision.

Response to Rule 702

(a) BACT is acceptable when equipped with a condenser. A condenser will be installed to comply with BACT.

(b) The maximum allowable emission rate specified by new source performance standards for dehydrators are located in 40 CFR 63, Subpart HH. Hazardous Air Pollutants (HAPs) associated with

the proposed dehydrator exceed benzene thresholds described in Subpart HH. A condenser will be installed to comply with subject benzene thresholds.

(c) Specified permit conditions have not yet been determined

(d) The new source has yet to be installed and no future compliance dates have been established.

Line Heaters and Heater Treater Burners

The line heaters and heater treater burners have maximum heat inputs less than 50,000,000 BTU per hour, which qualifies them for exemption under Michigan Air Quality Division (AQD) Rule 336.1282(b)(i). A permit to install is not required for subject burners but is included in this permit application to maintain an accurate site emission inventory.

Fixed Roof Tanks

Rule 284. Except as specified in R 336.1278, the requirement of R 336.1201(1) to obtain a permit to install does not apply to containers, reservoirs, or tanks used exclusively for any of the following:

(e) Storage of sweet crude or sweet condensate in a vessel that has a capacity of less than 40,000 gallons.

The tanks at subject site contain a maximum of 16,800 gallons therefore exempt from permitting by rule. A permit to install is not required for subject tanks but is included in this permit application to maintain an accurate site emission inventory

Emergency Flare

R 336.1288 Permit to install exemptions; oil and gas processing equipment.

Rule 288. The requirement of R 336.1201(1) to obtain a permit to install does not apply to any of the following: (c) A sweet gas flare. A permit to install is not required for subject flare but is included in this permit application to maintain an accurate site emission inventory

3.2 Title V Renewable Operating Permit Applicability

An emission inventory was compiled for the proposed facility, including sources exempt from the state permit system to determine whether a Title V Renewable Operating Permit (ROP) is required. A Title V ROP is not required for this facility, based on uncontrolled PTE less than major source levels. PTE of the criteria pollutants from the engine is less than 100 tons per year for nitrogen oxides and less than 100 tons for the remaining criteria pollutants; there is no lead. Potential to emit hazardous air pollutants (HAPs) from the above listed equipment, and from all possible leaking equipment, is less than 10 tons per year of any individual HAP, and less than 25 tons per year of total HAPs.

4.0 CONTROL TECHNOLOGY ANALYSIS

4.1 Compressor Engine

4.1.1 CAT 398 NA Compressor Engine EU00001

The CAT 398 compressor engine will be controlled with a three-way catalytic converter. The catalyst is designed for industrial natural gas engine applications. The element is placed in an integral insertion tracks within the catalyst housing. The element is sealed around the perimeter with a layer of Fiberfrax (a non-asbestos gasket), Duroblanket material, an element cover, and a catalyst access cover plate. Each catalyst element is designed for durable industrial operation with low pressure drop, and resistant to vibration and shock inherent in the catalyst's metal support design.

The catalytic converter will reduce emissions as follow:

NOx: 90%

CO: 80%

VOC: 50%

4.2 Dehydrator Reboiler/Burner

Detailed information on the dehydrator reboiler and the dehydrator burner are not included within this permit. No emission control is required to meet BACT/T-BACT limits, due to low uncontrolled emission rates from both units.

4.3 Heater Treaters, Line Heaters and Flare

All associated burners are uncontrolled.

4.4 Crude Oil Storage Tanks

Vapors from all crude oil tanks are controlled by capturing and routing to the flare.

5.0 STACK PARAMETERS

Compressor Engine Stack CAT 398 NA EU00001

Height above ground level: 36 feet

Inside Diameter: 8 inches

Orientation: Vertical (Up)

Fuel Input: 7.85 mmbtu/hp-hr

Exhaust Flow Rate: 3144 cfm @ stack temperature

Exhaust Stack Temperature: 1132° F

Source Classification Code: 2-02-002-53

Material (Natural Gas) Throughput Code 08

Dehydrator Burner Stack: 0.250 mmbtu/hr

Height above ground level: 36 feet

Inside Diameter: 6 inches

Orientation: Vertical

Burner Type: Atmospheric Mixture – Direct Fired

Air/Gas Ratio: 10:1

Exhaust Temperature: 800° F

Dehydrator Reboiler Vent EU00002

Height above ground level: 20 feet
Inside Diameter: 2 inches
Orientation: Vertical
Exhaust Temperature: 150° F
Source Classification Code: 3-10-003-23
Material (Natural Gas) Throughput Code 05

Heater Treater Stack: (9 identical) 0.750 mm/btu/hr

Height above ground level: 20 feet
Inside Diameter: 12 inches
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired

Line Heater Stack: (9 identical) 0.500 mm/btu/hr

Height above ground level: 20 feet
Inside Diameter: 12 inches
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired

Emergency Flare

Height above ground level: 20 feet
Inside Diameter: 8 inches
Allowable Flow Rate: 1.6 mmcf/day
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired

6.0 EMISSION CALCULATIONS

6.1 Calculations of Potential Emissions from the Natural Gas Engine

BASIS:

Potential emissions of Criteria pollutants were determined using emission factors provided by the Vendor.

6.1.1 CAT 398 NA Compressor Engine

Emission Factors:	9.4 (NOx) g/bhp-hr
	9.9 (CO) g/bhp-hr
	1.6 (HC) g/bhp-hr

Potential Emissions, tpy = (Brake Horse Power) x Emission Factor = (grams/hr)

Stack Concentration Calculation (CAT 398 NA)

Exhaust Flow Rate: 3,147 acfm
NOx: 12.42 lbs/hr (Uncontrolled)

Stack Conc.: = Emission Rate, $\frac{12.42 \text{ lb}}{\text{hr}} \times \frac{\text{hr}}{60 \text{ min}} \times \frac{453.6 \times 10^6 \text{ ug}}{\text{lb}} \times \frac{\text{min}}{3,147 \text{ ft}^3} \times (3.281 \text{ ft/m})^3$

6.2 Calculation of Potential Emissions from Glycol Dehydrator Reboiler

BASIS:

- ♦ Potential emissions of Criteria pollutants and Hazardous Air Pollutants (HAPS) were determined using GLYCalc Version 4.0 software (Appendix D)

6.3 Calculation of Potential Emissions Dehydrator Burner, Line Heaters, Heater Treaters, & Emergency Flare

- ♦ **AP-42** Emission Factors in lb/10⁶/ft³

Emission Factors:	140.0 (NOx)
	35.0 (CO)
	5.8 (VOC)

Dehydrator Burner

Fuel Gas volume (250,000 BTU/HR) / (1,000 btu/ft³) = 250 ft³/hr
(250 ft³/hr) / (1,000,000 ft³) x Factor = Emissions (lb/hr)

Line Heater & Heater Treater Burners

Fuel Gas volume (750,000 BTU/HR) / (1,000 btu/ft³) = 750 ft³/hr
(750 ft³/hr) / (1,000,000 ft³) x Factor = Emissions (lb/hr)

6.4 Fugitive Emissions

BASIS:

- ❖ Emission factors from USEPA document *New Equipment Leak Emission Factors for Oil and /Gas Production*.
- ❖ Gas composition analysis indicate no HAPS in subject source natural gas therefore calculations for fugitive HAP emissions have been omitted for this PTI.



TABLES

TABLE 2.1

Natural Gas-Fired Engine Uncontrolled Emissions
Adrian 25 CPF
Oil & Gas Production Facility

Equipment	Horse Power	Emission Factor (gm/bhp/hr)			Potential Emissions Tons/Year			
Engine	Brake	CO	NOx	HC	CO	NOx	HC	Stack Conc.
CAT 398 NA	600	9.90	9.40	1.60	57.3	54.4	9.30	2.2 e6 NOx

TABLE 2.2

Natural Gas-Fired Engine EU00001 Controlled Emissions
Adrian 25 CPF
Oil & Gas Production Facility

Equipment	Horse Power	Emission Factor (gm/bhp/hr)			Potential Emissions Tons/Year			
Engine	Brake	CO	NOx	HC	CO	NOx	HC	
CAT 398 NA	600	9.90	9.40	1.60	11.48	5.44	4.64	

TABLE 2.3

Dehydrator Burner Uncontrolled Emissions
Adrian 25 CPF
Oil & Gas Production Facility

Equipment	Natural Gas	Emission Factor (lb/10 ⁶ /ft ³)			Potential Emissions Pounds/Yr		
		CO	NOx	VOCs	CO	NOx	HCS
Burner	Thruput (mmcf/yr)						
Dehydrator Burner	2.19	35	140	2.8	76.6	308	6.14
Totals					76.6	308	6.14

TABLE 2.4

Dehydrator Reboiler Vent EU00002 Uncontrolled Emissions
Adrian 25 CPF
Oil & Gas Production Facility

Equipment	GLYCalc Version 4.0 Report	Potential Emissions Tons/Yr
Dehydrator	THC Tons/yr	Benzene
Dehydrator Reboiler	12.0248	0.2412

TABLE 2.5

Burner Emission Sources
Adrian 25 CPF
Oil & Gas Production Facility

Equipment	Number of Burners	Potential Emissions LBS/YR	
		NOx (Each)	NOx (Total)
Line Heaters	9	920	8,278
Heater Treaters	9	616	5,544
Dehydrator Burner	1	308	308
Totals			14,130

TABLE 2.6

Total All Emission Sources (Controlled and Uncontrolled)
Adrian 25 CPF
Oil & Gas Production Facility

Equipment	Tons/Yr		
	CO	NOx	HC
CAT 398 (Controlled) EU00001	11.480	5.440	4.6400
Dehydrator Reboiler EU00002	.0		12.3190
Heater Treaters (9)		2.772	
Dehydrator Burner		0.154	
Line Heaters (9)		4.139	
Emergency Flare		0.016	
Oil Tanks B/Loss (2) (Controlled)			0.0300
Oil Tanks W/Loss (2) (Controlled)			0.1690
Valves/Connections			0.2685
Truck Loadout			10.7310
Total	11.480	12.521	28.1575



APPENDIX A

SAVOY ENERGY, L.P.

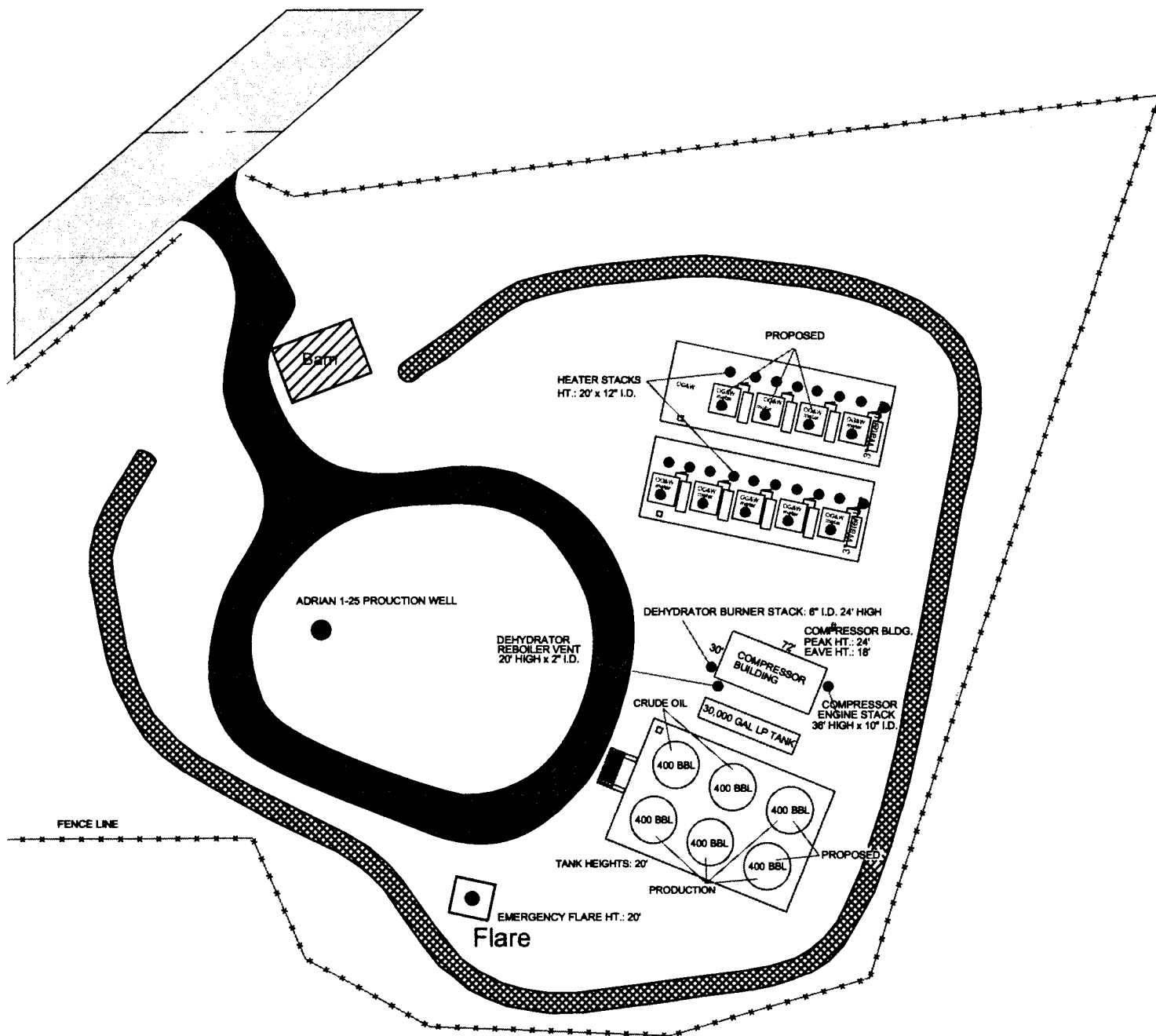
ADRIAN 25 CPF SCHEMATIC

T06S-R03E

Lenawee County, Michigan

WMC

11-14-2013



N
4

Note: Drawing not to scale.

SAVOY ENERGY, LP
ADRIAN, 1-25
S.W. 1/4 of N.W. 1/4 of N.E. 1/4 of SECTION 25,
T.6S., R.3E., ADRIAN TOWNSHIP,
LENAWEE COUNTY, MICHIGAN
SCALE 1"=600'

C/L CARSON HIGHWAY (GRAVEL)

WEST LINE SECTIONS 24 & 25

KIWANIS

BEAVER

STATE HIGHWAY M-52

NORTH & SOUTH 1/4 LINE SECTION 24, T.6S., R.3E.

TRAIL

DRAIN

CREEK

STATE HIGHWAY M-52

HOWELL HIGHWAY (ASPH)

PROPOSED WELL
ADRIAN, 1-25
LAT. N 41°55'28.763"
LON. W 84°00'55.554"

EAST & WEST 1/4 LINE SECTION 25, T.6S., R.3E.

APPROVED BY:

P.O. BOX 4003
JACKSON, MI 49204
(517)788-9806

SAVOY ENERGY, LP
ADRIAN, 1-25 CPF
PART of N 1/2 of SECTION 25,
T.6S., R.3E., ADRIAN TOWNSHIP,
LENAWEE COUNTY, MICHIGAN
SCALE 1"=120'

NORTH 1/4 POST
SECTION 25
T.6S., R.3E.

SECTION 25, T.6S., R.3E.
5294.11'

R-W LINE

C/L M-52
EDGE ASPHALT

R-W LINE

ARC LENGTH = 443.37'
D = 08°06'29"
R = 3133.10'
CB = N 45°11'57" E
CL = 443.06'

S 34°06'38" E
46.49'

N 79°24'12" E
99.56'

N 79°24'12" E 404.24'

S 05°02'20" E
102.09'

1.41 Acres

0.58 Acres

BARN

336.42'

30.93'

S 70°51'34" E 276.13'

N 83°10'03" E
156.52'

1.91'

281.43'

0.83 Acres

7.64 Acres

HEATER /
TREATERS

PIT

4.82 Acres

TANK
BATTERY

FLARE

S 79°31'14" W
59.51'

S 56°11'26" W 160.66'

S 20°13'02" W 400.86'

S 20°13'02" W 280.15'

N 41°08'43" E 146.60'

251.27'
N 86°10'44" W

N 01°43'16" W

NORTH & SOUTH 1/4 LINE

1032.46'

47'

157.58'

65.71'

474.56'

POB

S 01°53'41" E

SOUTH 1/4 POST
SECTION 25
T.6S., R.3E.

EXISTING WELL
ADRIAN, 1-25
P.N. 60666
LAT. N 41°55'28.763"
LON. W 84°00'55.554"

DRAWN BY: AWA
DATE: 2-MAY-13
DWG. NO.:
APPROVED BY:

WORTH SURVEYING

P.O. BOX 4003
JACKSON, MI 49204
(517)788-9806

APPENDIX B

Facility Name:
Operator: Savoy Energy, LLP

G398 EMISSIONS DATA

G398 EMISSIONS DATA @ STANDARD RATINGS

ENGINE	RATING (hp/rpm)	NOx	CO (gram/hp-hr)	HC	%O2	A/FR vol/vol	Tstack deg F	EXH FLOW cfm	AIR FLOW kg/hr	BSFC Btu/hp-hr
NA HCR	500/1200 stand/catalyst	12.7	13.7	2.0	0.5	9.5	1100	2261	1437	7800
NA HCR	412/1000 stand catalyst	18.3 11.2	0.8 12.1	1.2 1.7	2.0 0.5	10.5 9.5	1090 1101	1696 1838	1225 1139	7480 7669
NA LCR	450/1200 stand/catalyst	11.4	11.5	0.6	0.5	9.5	1202	2435	1459	6803
NA LCR	375/1000 stand catalyst	15.1 11.3	0.8 11.8	0.6 0.8	2.0 0.5	10.4 9.5	1000 1032	1778 1720	1220 1145	8273 8582
TA LCR	625/1200 stand catalyst	20.6 9.8	0.8 10.7	0.8 0.8	2.0 0.5	10.5 9.5	1040 1112	3063 3043	2040 1929	8026 8387
TA LCR	550/1000 stand catalyst	18.0 9.7	0.8 9.7	0.9 0.9	2.0 0.5	10.4 9.5	1004 1056	2558 2445	1750 1807	8011 8052
TA LCR	700/1200 stand	18.3	0.8	1.1	2.0	—	1096	3107	1999	7938
TA HCR	700/1200 stand catalyst	15.2 9.4	1.1 9.9	0.9 1.0	2.0 0.5	10.5 9.5	1103 1132	3278 3144	2155 1968	7778 7850
TA LCR	610/1000 stand	16.8	0.9	1.2	2.0	—	984	2484	1723	7846
TA HCR	610/1000 stand catalyst	14.9 8.9	0.8 9.6	1.1 1.8	2.0 0.5	10.5 9.5	1064 1075	2775 3032	1825 1696	7587 7804
TA HCR 32C LOW EMIS	700/1200 stand	5.0	1.8	1.4	8.2	13.6	1010	4482	3100	7843
TA HCR 32C LOW EMIS	610/1000 stand	5.0	1.2	2.0	7.8	14.2	960	3841	2770	7529
TA HCR 54C LOW EMIS	625/1200 stand	5.0	1.5	1.3	8.0	13.8	982	4136	2690	7791
TA HCR 54C LOW EMIS	550/1000 stand	5.0	1.3	1.7	8.7	14.2	929	3210	2350	7563

Note: G398 TA HCR @ 700 hp (catalyst) factors used; however engine's rated hp is 600 hp.



APPENDIX C



Emission Calculation Fact Sheet

Michigan Department Of Environmental Quality ♦ Environmental Science And Services Division ♦ (800) 662-9278

OIL AND GAS PRODUCTION FACILITIES

This document lists Source Classification Codes (SCC) and emission factors for various activities at oil and gas production facilities. They are provided as an aid in calculating emissions. These factors present one way to calculate emissions, **it is not required that facilities use these listed factors to quantify their emissions.** If a facility disagrees with any emission factor in this document, it may use other emission factors or methods of calculating emissions provided the emission factor or method correctly characterizes the processes at the facility and the resulting emissions. A facility doing so must provide documentation for the source of the emission factors or method used and justification for their use. For example, stack test data and manufacturer emission specifications provide more accurate emission estimates than the use of general emission factors.

Control factors

The listed emission factors are for uncontrolled emissions. If a facility has control equipment, such as a condenser, the emissions can be multiplied by the control factor.

Calculate the control factor by subtracting the percent control efficiency from 100 and then divide that number by 100. For example, if the control efficiency is 87%, the control factor would be $(100 - 87)/100 = 0.13$. Control efficiencies may be listed on the equipment or in the equipment documentation. Alternatively, equipment suppliers can provide control efficiency values.

Scientific notation

The emission factors are expressed in scientific notation, which means that the decimal point has been moved. If the exponent is negative, move the decimal point to the left. If the exponent is positive, move the decimal point to the right. If the exponent is zero, the decimal point does not move. For example, if a number is expressed as 2.0E-1, move the decimal point one place to the left to get 0.20. If a number is expressed as 2.0E2, move the decimal point 2 places to the right to get 200. If a number is expressed as 2.0E0, the decimal point does not move. The number is 2.0.

NATURAL GAS FIRED ENGINES

Report all "standard" engine emissions together, and report all "lean burn" emission engines together. For facilities with both "standard" and "lean burn" emission engines, report "standard" engines and "lean burn" emission engines as separate emission units. Split the total fuel gas between the two different types of engines based on your best estimate of the relative amount of fuel burned in each type of engine at the facility.

You may group all natural gas combustion equipment with your standard "rich burn" or lean burn engines using the SCCs below. For example you may group all standard "rich burn" engines, natural gas process heaters, production compressors, and flares together under the SCC 2-02-002-53. Process heaters can also be reported separately using the appropriate SCC on page 2 of the fact sheet.

While the factors below are acceptable for MAERS reporting, it is highly recommended that emission factors from equipment vendor guarantees or from source specific testing (stack testing) be used.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS	CONTROL EFFICIENCY
2-02-002-53	Standard "rich burn" engines May include: <ul style="list-style-type: none">Natural gas process heatersNatural gas production, compressorsNatural gas production, flares-excluding SO₂	CO NOx PM10 PM2.5 SO ₂ VOC	3.794E3 LB/MMCF NATURAL GAS* 2.254E3 LB/MMCF NATURAL GAS* 9.69E0 LB/MMCF NATURAL GAS* 9.69E0 LB/MMCF NATURAL GAS* 6.00E-1 LB/MMCF NATURAL GAS* 3.02E1 LB/MMCF NATURAL GAS*	3-way Catalyst CO - 80%** NOX - 90%** VOC - 50%**
2-02-002-54	Lean burn engines May include: <ul style="list-style-type: none">Natural gas process heatersNatural gas production, compressorsNatural gas production, flares-excluding SO₂	CO NOx PM10 PM2.5 SO ₂ VOC	5.68E2 LB/MMCF NATURAL GAS* 4.162E3 LB/MMCF NATURAL GAS* 7.90E-2 LB/MMCF NATURAL GAS* 7.90E-2 LB/MMCF NATURAL GAS* 6.00E-1 LB/MMCF NATURAL GAS* 1.204E2 LB/MMCF NATURAL GAS*	Oxidation Catalyst CO - 80%** VOC - 50%**

* The emission factors listed are derived from AP-42 Chapter 3.2 (Tables 3.2-2 and 3.2-3).

** The control factors listed above can only be used if documentation is on file showing that the catalyst was inspected and maintained. If actual control efficiencies are different than those listed above, use the actual control efficiency.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS	CONTROL EFFICIENCY
PROCESS HEATERS: Include process heaters as a separate emission unit if they were not grouped with natural gas fired engines. The emission factors for process heaters come from the US EPA's Factor Information Retrieval (FIRE) data system, which can be accessed at http://cfpub.epa.gov/oarweb/index.cfm?action=fire.main . (Emission factors from Chapter 1.4 [Table 1.4-1] of US EPA's AP-42 Compilation of Air Pollutant Emission Factors may also be used to calculate emissions from process heaters.)				
3-10-004-04	Process Heater	CO NO _x PM ₁₀ SO _x VOC	3.50E1 LB/MMCF NATURAL GAS 1.40E2 LB/MMCF NATURAL GAS 3.00E0 LB/MMCF NATURAL GAS 6.00E-1 LB/MMCF NATURAL GAS 2.80E0 LB/MMCF NATURAL GAS	
TANK STORAGE: You may also use the US EPA TANKS 4.0 software to estimate emissions from tank storage. This software can be downloaded at www.epa.gov/ttn/chief/software/tanks/index.html .				
4-04-003-01	Fixed roof tank: breathing loss	VOC	3.6E1 LB/KGAL-YR CRUDE OIL (storage capacity)	Vapor recovery system - 95% Flare - 95%
4-04-003-02	Fixed roof tank: working loss <i>R. 336.1284(e) < 40,000 g</i>	VOC	1.1E0 LB/E3 GAL CRUDE OIL (throughput) <i>400/0.1</i>	Vapor recovery system - 95% Flare - 95%
TRUCK LOADING				
4-06-001-32	Truck loading	VOC	2.0E0 LB/E3 GAL CRUDE OIL	Vapor recovery system - 95%
GAS DEHYDRATORS You may also use GRI-GLYCalc™ 4.0 software developed by the Gas Research Institute (GRI) to estimate emissions from glycol dehydrators. This software can be purchased at www.gastechnology.org .				
3-10-003-21	Glycol dehydrator – Niagaran	VOC	9.24E4 LB/YR-GPM GLYCOL*	Tube and shell condenser with flash tank - 90% Vapor recovery system - 95% Flare - 95%
3-10-003-22	Glycol dehydrator – Prairie du Chein	VOC	1.94E4 LB/YR-GPM GLYCOL*	Tube and shell condenser with flash tank - 90% Vapor recovery system - 95% Flare - 95%
3-10-003-23	Glycol dehydrator – Antrim	VOC	9.2E1 LB/YR-GPM GLYCOL*	Vapor recovery system - 95% Flare - 95%
* YR-GPM GLYCOL = gallon per minute glycol circulated, averaged over one year				
AMINE PLANT				
3-06-009-06	Amine plant	SO ₂	3.76E3 LB/TON HYDROGEN SUL	

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS	CONTROL EFFICIENCY
FUGITIVE EMISSIONS: Facilities considered to be a "major source" under Title V of the Clean Air Act are required to calculate their regulated fugitive emissions (fugitive emissions from crude oil sumps do not have to be reported to MAERS).				
3-10-888-01	Fugitive emissions – Light crude production	VOC	1.44E1 LB/EACH-YR VALVE	
3-10-888-02	Fugitive emissions – Gas production	VOC	3.6E0 LB/EACH-YR VALVE	
3-10-888-03	Fugitive emissions – Gas plant	VOC	2.74E1 LB/EACH-YR VALVE	

SAMPLE CALCULATIONS

- For a Glycol dehydrator (Niagaran) equipped with a vapor recovery system, where 0.3 GPM of glycol is circulated, the VOC emissions would be calculated as follows:

$$\text{VOC: } \underset{\text{Throughput}}{0.3 \text{ GPM}} \times \underset{\text{Emission Factor}}{9.24\text{E4 LBS/YR-GPM}} \times \underset{\text{Conversion Factor}}{0.0005 \text{ LB/TON}} \times \underset{\text{Control Factor}}{(100 - 95)/100} = 0.69 \text{ TON VOC}$$

- For standard "rich burn" engines with a properly maintained 3-way catalyst where 4.25 MMCF of fuel gas was burned, the CO emissions would be calculated as follows:

$$\text{CO: } 4.25 \text{ MMCF} \times 3,794 \text{ LB CO/MMCF} \times 0.0005 \text{ LB/TON} \times (100 - 80)/100 = 1.61 \text{ TON CO}$$

- For lean burn engines where 4.25 MMCF of fuel gas was burned, the CO emissions would be calculated as follows:

$$\text{CO: } 4.25 \text{ MMCF} \times 568 \text{ LB CO/MMCF} \times 0.0005 \text{ LB/TON} = 1.21 \text{ TON CO}$$



APPENDIX D

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Adrian 25 CPF

File Name: C:\Users\wcockrum\Documents\ECT Documents\Savoy Energy\Adrian 25 CPF\Adrian 25 Dehy Calc 2013.ddf

Date: November 12, 2013

DESCRIPTION:

Description: Dehydrator Emission Inventory 2013

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.0212	0.509	0.0930
Ethane	0.0459	1.103	0.2013
Propane	0.1431	3.434	0.6268
Isobutane	0.0510	1.225	0.2235
n-Butane	0.2015	4.837	0.8828
Isopentane	0.0716	1.717	0.3134
n-Pentane	0.1532	3.678	0.6712
n-Hexane	0.0975	2.339	0.4269
Cyclohexane	0.1984	4.762	0.8690
Other Hexanes	0.1076	2.583	0.4714
Heptanes	0.5474	13.138	2.3977
Benzene	0.0551	1.322	0.2412
Toluene	0.1441	3.459	0.6312
Ethylbenzene	0.0818	1.963	0.3582
Xylenes	0.5059	12.142	2.2159
C8+ Heavies	0.3871	9.291	1.6957
Total Emissions	2.8126	67.501	12.3190
Total Hydrocarbon Emissions	2.8126	67.501	12.3190
Total VOC Emissions	2.7454	65.889	12.0248
Total HAP Emissions	0.8843	21.224	3.8733
Total BTEX Emissions	0.7869	18.885	3.4464

EQUIPMENT REPORTS:

ABSORBER

Calculated Absorber Stages: 2.15
 Specified Dry Gas Dew Point: 7.00 lbs. H2O/MMSCF
 Temperature: 60.0 deg. F
 Pressure: 40.0 psig
 Dry Gas Flow Rate: 0.4000 MMSCF/day
 Glycol Losses with Dry Gas: 0.0005 lb/hr

Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 225.84 lbs. H2O/MMSCF
 Calculated Lean Glycol Recirc. Ratio: 4.93 gal/lb H2O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	3.08%	96.92%
Carbon Dioxide	99.89%	0.11%
Nitrogen	99.99%	0.01%
Methane	99.99%	0.01%
Ethane	99.98%	0.02%
Propane	99.94%	0.06%
Isobutane	99.89%	0.11%
n-Butane	99.84%	0.16%
Isopentane	99.79%	0.21%
n-Pentane	99.71%	0.29%
n-Hexane	99.36%	0.64%
Cyclohexane	97.31%	2.69%
Other Hexanes	99.55%	0.45%
Heptanes	98.35%	1.65%
Benzene	74.21%	25.79%
Toluene	55.67%	44.33%
Ethylbenzene	30.14%	69.86%
Xylenes	18.75%	81.25%
C8+ Heavies	91.73%	8.27%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	40.85%	59.15%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	3.20%	96.80%
Other Hexanes	1.00%	99.00%
Heptanes	0.50%	99.50%
Benzene	5.00%	95.00%
Toluene	7.90%	92.10%
Ethylbenzene	10.40%	89.60%
Xylenes	12.90%	87.10%
C8+ Heavies	11.99%	88.01%

STREAM REPORTS:

WET GAS STREAM

Temperature: 60.00 deg. F
 Pressure: 54.70 psia
 Flow Rate: 1.68e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	4.76e-001	3.78e+000
Carbon Dioxide	1.89e-001	3.67e+000
Nitrogen	5.48e+000	6.78e+001
Methane	5.64e+001	3.99e+002
Ethane	1.42e+001	1.89e+002
Propane	1.19e+001	2.32e+002
Isobutane	1.76e+000	4.51e+001
n-Butane	4.86e+000	1.25e+002
Isopentane	1.05e+000	3.33e+001
n-Pentane	1.65e+000	5.26e+001
n-Hexane	3.97e-001	1.51e+001
Cyclohexane	1.98e-001	7.37e+000
Other Hexanes	6.23e-001	2.37e+001
Heptanes	7.50e-001	3.32e+001
Benzene	6.19e-003	2.14e-001
Toluene	7.99e-003	3.25e-001
Ethylbenzene	2.50e-003	1.17e-001
Xylenes	1.33e-002	6.23e-001
C8+ Heavies	6.22e-002	4.68e+000
Total Components	100.00	1.24e+003

DRY GAS STREAM

Temperature: 60.00 deg. F
 Pressure: 54.70 psia
 Flow Rate: 1.67e+004 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.47e-002	1.17e-001
Carbon Dioxide	1.90e-001	3.66e+000
Nitrogen	5.51e+000	6.78e+001
Methane	5.67e+001	3.99e+002
Ethane	1.43e+001	1.89e+002
Propane	1.19e+001	2.31e+002
Isobutane	1.76e+000	4.50e+001
n-Butane	4.87e+000	1.24e+002
Isopentane	1.05e+000	3.32e+001
n-Pentane	1.66e+000	5.25e+001
n-Hexane	3.97e-001	1.50e+001
Cyclohexane	1.94e-001	7.17e+000
Other Hexanes	6.24e-001	2.36e+001
Heptanes	7.42e-001	3.27e+001
Benzene	4.62e-003	1.58e-001
Toluene	4.47e-003	1.81e-001
Ethylbenzene	7.56e-004	3.53e-002

Xylenes	2.50e-003	1.17e-001
C8+ Heavies	5.74e-002	4.29e+000

Total Components	100.00	1.23e+003
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LEAN GLYCOL STREAM

Temperature: 60.00 deg. F
Flow Rate: 3.00e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.84e+001	1.66e+002
Water	1.50e+000	2.53e+000
Carbon Dioxide	2.29e-013	3.87e-013
Nitrogen	2.07e-013	3.50e-013
Methane	4.22e-019	7.13e-019
Ethane	1.28e-008	2.17e-008
Propane	3.45e-009	5.82e-009
Isobutane	9.07e-010	1.53e-009
n-Butane	2.96e-009	5.00e-009
Isopentane	2.13e-004	3.60e-004
n-Pentane	4.56e-004	7.70e-004
n-Hexane	2.90e-004	4.90e-004
Cyclohexane	3.88e-003	6.56e-003
Other Hexanes	6.44e-004	1.09e-003
Heptanes	1.63e-003	2.75e-003
Benzene	1.72e-003	2.90e-003
Toluene	7.32e-003	1.24e-002
Ethylbenzene	5.62e-003	9.49e-003
Xylenes	4.44e-002	7.49e-002
C8+ Heavies	3.12e-002	5.28e-002
Total Components	100.00	1.69e+002

RICH GLYCOL STREAM

Temperature: 60.00 deg. F
Pressure: 54.70 psia
Flow Rate: 3.13e-001 gpm
NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.48e+001	1.66e+002
Water	3.54e+000	6.20e+000
Carbon Dioxide	2.21e-003	3.87e-003
Nitrogen	1.99e-003	3.48e-003
Methane	1.21e-002	2.12e-002
Ethane	2.62e-002	4.59e-002
Propane	8.16e-002	1.43e-001
Isobutane	2.91e-002	5.10e-002
n-Butane	1.15e-001	2.02e-001
Isopentane	4.10e-002	7.19e-002
n-Pentane	8.79e-002	1.54e-001
n-Hexane	5.59e-002	9.79e-002
Cyclohexane	1.17e-001	2.05e-001

Other Hexanes	6.20e-002	1.09e-001
Heptanes	3.14e-001	5.50e-001
Benzene	3.31e-002	5.80e-002
Toluene	8.93e-002	1.56e-001
Ethylbenzene	5.21e-002	9.13e-002
Xylenes	3.31e-001	5.81e-001
C8+ Heavies	2.51e-001	4.40e-001

Total Components	100.00	1.75e+002
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REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 9.02e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	8.57e+001	3.67e+000
Carbon Dioxide	3.70e-002	3.87e-003
Nitrogen	5.23e-002	3.48e-003
Methane	5.57e-001	2.12e-002
Ethane	6.43e-001	4.59e-002
Propane	1.36e+000	1.43e-001
Isobutane	3.69e-001	5.10e-002
n-Butane	1.46e+000	2.02e-001
Isopentane	4.17e-001	7.16e-002
n-Pentane	8.93e-001	1.53e-001
n-Hexane	4.76e-001	9.75e-002
Cyclohexane	9.92e-001	1.98e-001
Other Hexanes	5.25e-001	1.08e-001
Heptanes	2.30e+000	5.47e-001
Benzene	2.97e-001	5.51e-002
Toluene	6.58e-001	1.44e-001
Ethylbenzene	3.24e-001	8.18e-002
Xylenes	2.00e+000	5.06e-001
C8+ Heavies	9.56e-001	3.87e-001
Total Components	100.00	6.49e+000



APPENDIX E



JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



STEVEN E. CHESTER
DIRECTOR

Variance
Suspension of Enforcement of Rule 225
For
Certain Natural Gas Combustion Emissions

1. Variance Statement

In accordance with the provisions of Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), a variance is granted for a period of one year from the effective date of this document, suspending the requirements of Rule 225, promulgated pursuant to Act 451 (R 336.1225 *Health-based screening level requirement for new or modified sources of air toxics*) for each emission unit that combusts natural gas as fuel and meets either of the following criteria:

1. Fuel-burning equipment or natural gas fired equipment, with a maximum natural gas usage rate of 50,000 cubic feet per hour or less, where the emissions from the natural gas combustion are discharged unobstructed vertically upwards from an emissions discharge point at least 1.5 times the height of the building most influential in determining the predicted ambient impacts of the emissions.
2. Air pollution control equipment, as defined by Act 451, not limited in the natural gas usage rate.

This variance is limited to the emissions from the combustion of natural gas only. The requirements of Rule 225 are not suspended for any emissions from the emission unit not resulting from the combustion of natural gas.

The source types that may qualify for this variance include, but are not limited to, natural gas fired boilers, internal combustion engines, and regenerative thermal oxidizers. This variance does not obviate the need for persons to apply for and obtain air use permits to install as required by Rule 201 (R 336.1201 *Permits to install*) unless otherwise exempt. However, while this variance is in effect, persons applying for a permit under Rule 201 for an emission unit(s) that meets either of the above-listed criteria will not need to demonstrate compliance with Rule 225 for emissions related to combustion of natural gas.

Permits issued while this variance is in effect will remain valid and in full force irrespective of the effective dates of this variance.

2. Regulatory Background

Part 55 of Act 451, along with rules promulgated pursuant to Act 451, regulates emissions of air pollutants to the ambient air.

Section 5535 (MCL 324.5535 *Suspension of enforcement; reasons; variance*) of Act 451 allows the Department to suspend enforcement of any rule that would be an unreasonable hardship upon the person, provided it is granted by variance and it does not violate the federal Clean Air Act (CAA).

Section 5536 (MCL 324.5536 *Variance; considerations effecting*) specifies considerations the Department shall give due recognition to in granting any variance, and conditions and requirements that shall apply.

Section 5538 (MCL 324.5538 *Variance; period granted; report; conditions*) specifies that any variance granted pursuant to Section 5535 shall be for a period of time specified by the Department at the time of granting but not to exceed one year. However, any variance may be continued from year to year.

Rule 225 (*Health-based screening level requirement for new or modified sources of air toxics*) requires that the person responsible for the new or modified source of air toxics comply with the health-based screening levels established by the Department.

3. Justification for the Department's Position

The Department has received and evaluated permit applications for natural gas combustion processes. Under Rule 225, some of these processes would not meet the requirements of the rule for one or more air toxic contaminants (acrolein being one) based upon the most recent technical data and information available to the applicant and the Department.

Requiring compliance with Rule 225 for the natural gas combustion portion of the sources qualifying for this variance would create an undue hardship and would be out of proportion to the benefits to be obtained by compliance. Natural gas is recognized as an environmentally beneficial, clean burning fuel. There is no better readily available alternative fuel for some sources at this time.

This variance will not cause violations of the CAA. While many of the sources that qualify for this variance are also regulated under the CAA, this variance does not exempt these sources from obtaining a permit under Rule 201 and complying with all aspects of the CAA.


Good engineering practice will be applied to sources that qualify for the variance to assure a continuing level of public health protection. Specifically, emissions from sources other than air pollution control equipment (e.g., regenerative thermal oxidizer) must be discharged unobstructed vertically upwards and stack heights must be at least 1.5 times the height of the most influential building to provide adequate dispersion of the emissions.

The Department believes further study is needed as to the toxic air contaminant emissions from the combustion of natural gas, in particular the toxics information for acrolein, and other possible alternatives to address this issue and to protect public health and the environment.

Final Approval

The Chief of the Air Quality Division, having had opportunity to review the variance and having been delegated authority to grant variances by the Director of the Michigan Department of Environmental Quality pursuant to the provisions of Part 55 of Act 451 and otherwise being fully advised on the premises,

Hereby grants the variance, which shall be entered in the record of the Department.



G. Vinson Hellwig, Chief
Air Quality Division
Michigan Department of Environmental Quality

Effective Date: January 20, 2006

Continuation of Variance

The Chief of the Air Quality Division, having had opportunity to review the above variance effective on January 20, 2006, and having been delegated authority to grant and continue variances by the Director of the Michigan Department of Natural Resources and Environment pursuant to the provisions of Part 55 of Act 451 and otherwise being fully advised of the premises,

hereby continues the variance for a period of one year, which shall be entered in the record of the Department.



G. Vinson Hellwig, Chief
Air Quality Division
Michigan Department of Natural Resources and Environment

Effective Date: January 21, 2010

Air quality



RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



DAN WYANT
DIRECTOR

DEC 23 2011

December 20, 2011

Mr. Thomas Pangborn
Savoy Energy LP – Goetz 8 Trust CPF
P.O. Box 1560
Traverse City, Michigan 49685

Dear Mr. Pangborn:

This letter is in reference to your Permit to Install application for adding two new engines to the existing central production facility (State Registration Number P0260) located in Section 8 of Adrian Township, Lenawee County, Michigan. This application, identified as No. 121-11A, has been evaluated and approved by the Air Quality Division (AQD), pursuant to the delegation of authority from the Michigan Department of Environmental Quality (DEQ).

This approval is based upon and subject to compliance with all administrative rules promulgated pursuant to Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), and conditions stipulated in the attached supplement. Please review these conditions thoroughly so that you may take the actions necessary to ensure compliance with all of these conditions.

Please note, this permit includes enforceable limits for oxides of nitrogen (NO_x) which have been accepted to restrict the facility's potential to emit to less than the major source threshold to opt out of the Renewable Operating Permit (ROP) Program.

Also, Permit to Install No. 121-11 has been voided because the equipment is now covered by Permit to Install No. 121-11A.

The engines covered by this permit are required to operate in accordance with a Preventative Maintenance/Malfunction Abatement Plan (PM / MAP). The PM / MAP Checklist, listing the items required in the plan, and the PM / MAP Checklist Guidance Document, describing each item in the checklist, are attached. The final plan is to be submitted to the Jackson District Office no later than 60 days after issuance of this permit.

To help us improve the service we provide our customers, we encourage you to complete a *Permit to Install Customer Service Survey* on the following Web page:

http://www.michigan.gov/documents/deq/DEQEval_29-pti-customerservice_287285_7.html

Please contact me if you have any questions regarding this permit.

Sincerely,

Jeremy W. Hoeh, P.E.
Permit Section, Air Quality Division
517-241-2194
hoehj@michigan.gov

Attachment

cc/att: Mr. Wayne Cockrum, ECT Inc
Mr. Scott Miller, DEQ

**MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION**

December 7, 2011

**PERMIT TO INSTALL
121-11A**

ISSUED TO
Savoy Energy LP – Goetz 8 Trust CPF

LOCATED AT
Section 8
Adrian Township, Michigan

IN THE COUNTY OF
Lenawee

STATE REGISTRATION NUMBER
P0260

The Air Quality Division has approved this Permit to Install, pursuant to the delegation of authority from the Michigan Department of Environmental Quality. This permit is hereby issued in accordance with and subject to Section 5505(1) of Article II, Chapter I, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Pursuant to Air Pollution Control Rule 336.1201(1), this permit constitutes the permittee's authority to install the identified emission unit(s) in accordance with all administrative rules of the Department and the attached conditions. Operation of the emission unit(s) identified in this Permit to Install is allowed pursuant to Rule 336.1201(6).

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: December 5, 2011	
DATE PERMIT TO INSTALL APPROVED: December 7, 2011	SIGNATURE: 
DATE PERMIT VOIDED:	SIGNATURE:
DATE PERMIT REVOKED:	SIGNATURE:

PERMIT TO INSTALL

Table of Contents

Section	Page
Alphabetical Listing of Common Abbreviations / Acronyms	2
General Conditions	3
Special Conditions	5
Emission Unit Summary Table	5
Special Conditions for EUDEHY	6
Flexible Group Summary Table	9
Special Conditions for FGENGINEs	10
Special Conditions for FGFACILITY	14
Appendix A	16

Common Abbreviations / Acronyms

Common Acronyms		Pollutant / Measurement Abbreviations	
AQD	Air Quality Division	BTU	British Thermal Unit
BACT	Best Available Control Technology	°C	Degrees Celsius
CAA	Clean Air Act	CO	Carbon Monoxide
CEM	Continuous Emission Monitoring	dscf	Dry standard cubic foot
CFR	Code of Federal Regulations	dscm	Dry standard cubic meter
COM	Continuous Opacity Monitoring	°F	Degrees Fahrenheit
EPA	Environmental Protection Agency	gr	Grains
EU	Emission Unit	Hg	Mercury
FG	Flexible Group	hr	Hour
GACS	Gallon of Applied Coating Solids	H ₂ S	Hydrogen Sulfide
GC	General Condition	hp	Horsepower
HAP	Hazardous Air Pollutant	lb	Pound
HVLP	High Volume Low Pressure *	m	Meter
ID	Identification	mg	Milligram
LAER	Lowest Achievable Emission Rate	mm	Millimeter
MACT	Maximum Achievable Control Technology	MM	Million
MAERS	Michigan Air Emissions Reporting System	MW	Megawatts
MAP	Malfunction Abatement Plan	ng	Nanogram
MDEQ	Michigan Department of Environmental Quality (Department)	NO _x	Oxides of Nitrogen
MSDS	Material Safety Data Sheet	PM	Particulate Matter
NESHAP	National Emission Standard for Hazardous Air Pollutants	PM ₁₀	PM less than 10 microns diameter
NSPS	New Source Performance Standards	PM _{2.5}	PM less than 2.5 microns diameter
NSR	New Source Review	pph	Pounds per hour
PS	Performance Specification	ppm	Parts per million
PSD	Prevention of Significant Deterioration	ppmv	Parts per million by volume
PTE	Permanent Total Enclosure	ppmw	Parts per million by weight
PTI	Permit to Install	psia	Pounds per square inch absolute
RACT	Reasonably Available Control Technology	psig	Pounds per square inch gauge
ROP	Renewable Operating Permit	scf	Standard cubic feet
SC	Special Condition	sec	Seconds
SCR	Selective Catalytic Reduction	SO ₂	Sulfur Dioxide
SRN	State Registration Number	THC	Total Hydrocarbons
TAC	Toxic Air Contaminant	tpy	Tons per year
TEQ	Toxicity Equivalence Quotient	µg	Microgram
VE	Visible Emissions	VOC	Volatile Organic Compound
		yr	Year

* For High Volume Low Pressure (HVLP) applicators, the pressure measured at the HVLP gun air cap shall not exceed ten (10) pounds per square inch gauge (psig).

GENERAL CONDITIONS

1. The process or process equipment covered by this permit shall not be reconstructed, relocated, or modified, unless a Permit to Install authorizing such action is issued by the Department, except to the extent such action is exempt from the Permit to Install requirements by any applicable rule. **(R 336.1201(1))**
2. If the installation, construction, reconstruction, relocation, or modification of the equipment for which this permit has been approved has not commenced within 18 months, or has been interrupted for 18 months, this permit shall become void unless otherwise authorized by the Department. Furthermore, the permittee or the designated authorized agent shall notify the Department via the Supervisor, Permit Section, Air Quality Division, Michigan Department of Environmental Quality, P.O. Box 30260, Lansing, Michigan 48909, if it is decided not to pursue the installation, construction, reconstruction, relocation, or modification of the equipment allowed by this Permit to Install. **(R 336.1201(4))**
3. If this Permit to Install is issued for a process or process equipment located at a stationary source that is not subject to the Renewable Operating Permit program requirements pursuant to R 336.1210, operation of the process or process equipment is allowed by this permit if the equipment performs in accordance with the terms and conditions of this Permit to Install. **(R 336.1201(6)(b))**
4. The Department may, after notice and opportunity for a hearing, revoke this Permit to Install if evidence indicates the process or process equipment is not performing in accordance with the terms and conditions of this permit or is violating the Department's rules or the Clean Air Act. **(R 336.1201(8), Section 5510 of Act 451, PA 1994)**
5. The terms and conditions of this Permit to Install shall apply to any person or legal entity that now or hereafter owns or operates the process or process equipment at the location authorized by this Permit to Install. If the new owner or operator submits a written request to the Department pursuant to R 336.1219 and the Department approves the request, this permit will be amended to reflect the change of ownership or operational control. The request must include all of the information required by subrules (1)(a), (b), and (c) of R 336.1219 and shall be sent to the District Supervisor, Air Quality Division, Michigan Department of Environmental Quality. **(R 336.1219)**
6. Operation of this equipment shall not result in the emission of an air contaminant which causes injurious effects to human health or safety, animal life, plant life of significant economic value, or property, or which causes unreasonable interference with the comfortable enjoyment of life and property. **(R 336.1901)**
7. The permittee shall provide notice of an abnormal condition, start-up, shutdown, or malfunction that results in emissions of a hazardous or toxic air pollutant which continue for more than one hour in excess of any applicable standard or limitation, or emissions of any air contaminant continuing for more than two hours in excess of an applicable standard or limitation, as required in Rule 912, to the Department. The notice shall be provided not later than two business days after start-up, shutdown, or discovery of the abnormal condition or malfunction. Written reports, if required, must be filed with the Department within 10 days after the start-up or shutdown occurred, within 10 days after the abnormal conditions or malfunction has been corrected, or within 30 days of discovery of the abnormal condition or malfunction, whichever is first. The written reports shall include all of the information required in Rule 912(5). **(R 336.1912)**
8. Approval of this permit does not exempt the permittee from complying with any future applicable requirements which may be promulgated under Part 55 of 1994 PA 451, as amended or the Federal Clean Air Act.
9. Approval of this permit does not obviate the necessity of obtaining such permits or approvals from other units of government as required by law nor does it affect any liability for past violations under the Environmental Quality Protection Act, 1994 PA 451.
10. Operation of this equipment may be subject to other requirements of Part 55 of 1994 PA 451, as amended and the rules promulgated thereunder.

11. Except as provided in subrules (2) and (3) or unless the special conditions of the Permit to Install include an alternate opacity limit established pursuant to subrule (4) of R 336.1301, the permittee shall not cause or permit to be discharged into the outer air from a process or process equipment a visible emission of density greater than the most stringent of the following. The grading of visible emissions shall be determined in accordance with R 336.1303. **(R 336.1301)**
 - a) A six-minute average of 20 percent opacity, except for one six-minute average per hour of not more than 27 percent opacity.
 - b) A visible emission limit specified by an applicable federal new source performance standard.
 - c) A visible emission limit specified as a condition of this permit to install.
12. Collected air contaminants shall be removed as necessary to maintain the equipment at the required operating efficiency. The collection and disposal of air contaminants shall be performed in a manner so as to minimize the introduction of contaminants to the outer air. Transport of collected air contaminants in Priority I and II areas requires the use of material handling methods specified in R 336.1370(2). **(R 336.1370)**
13. The Department may require the permittee to conduct acceptable performance tests, at the permittee's expense, in accordance with R 336.2001 and R 336.2003, under any of the conditions listed in R 336.2001. **(R 336.2001)**

SPECIAL CONDITIONS

EMISSION UNIT SUMMARY TABLE

The descriptions provided below are for informational purposes and do not constitute enforceable conditions.

Emission Unit ID	Emission Unit Description (Process Equipment & Control Devices)	Flexible Group ID
EUDEHY	Glycol dehydration system processing gas from the Trenton/Black River zone	
EUENGINE1	Natural gas fired reciprocating engine	FGENGINES
EUENGINE2	Natural gas fired reciprocating engine	FGENGINES
EUENGINE3	Natural gas fired reciprocating engine	FGENGINES

The following conditions apply to: EUDEHY

DESCRIPTION: Glycol dehydration system processing natural gas

Flexible Group ID: NA

POLLUTION CONTROL EQUIPMENT: NA

I. EMISSION LIMITS

NA

II. MATERIAL LIMITS

1. The permittee shall not use stripping gas in EUDEHY. (R 336.1205, R 336.1225, R 336.1702(a), R 336.1901)

III. PROCESS/OPERATIONAL RESTRICTIONS

1. The permittee shall comply with all provisions of the National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 63, Subpart HH, as they apply to EUDEHY. (40 CFR Part 63, Subpart HH)
2. The glycol recirculation rate for EUDEHY shall not exceed a maximum of 0.67 gallons per minute. (R 336.1205, R 336.1225, R 336.1702(a), R 336.1901)

IV. DESIGN/EQUIPMENT PARAMETERS

NA

V. TESTING/SAMPLING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

1. At least once each calendar year the permittee shall obtain, by sampling, an analysis of the wet gas stream. The permittee shall analyze the sample for nitrogen, carbon dioxide, hydrogen sulfide, C1 through C6 series hydrocarbons, benzene, toluene, xylene, ethylbenzene, and heptanes plus. The permittee must submit any request for a change in the sampling frequency to the AQD District Supervisor for review and approval. (R 336.1205, R 336.1225, R 336.1702(a), R 336.1901)

VI. MONITORING/RECORDKEEPING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

1. The permittee shall complete all required calculations in a format acceptable to the AQD District Supervisor by the last day of the calendar month, for the previous calendar month, unless otherwise specified in any monitoring/recordkeeping special condition. (R 336.1205, R 336.1225, R 336.1702(a), R 336.1901)
2. The permittee shall install, calibrate, maintain and operate in a satisfactory manner a device to monitor the glycol recirculation rate of EUDEHY on a continuous basis. (R 336.1205, R 336.1225, R 336.1702(a), R 336.1901, R 336.1910)

3. If EUDEHY meets the exemption criteria in 40 CFR 63.764(e)(1)(i) for glycol dehydrators with actual annual average flow rate of natural gas less than 85,000 cubic meters per day, the actual flow rate of natural gas shall be determined using either of the procedures below:
 - a) The permittee shall install and operate a monitoring instrument that directly measures natural gas flow rate to the glycol dehydration unit with an accuracy of plus or minus 2 percent or better. The permittee shall convert annual natural gas flow rate to a daily average by dividing the annual flow rate by the number of days per year the glycol dehydration unit processed natural gas. **(40 CFR 63.772(b)(1)(i))**
 - b) The permittee shall document, to the AQD District Supervisor's satisfaction, that the actual annual average natural gas flow rate to the glycol dehydration unit is less than 85,000 cubic meters per day. **(40 CFR 63.772(b)(1)(ii))**

As an alternative, if EUDEHY meets the exemption criteria in 40 CFR 63.764(e)(1)(ii) for glycol dehydrators with actual average benzene emissions less than 0.90 megagram per year, the emissions shall be determined either uncontrolled, or with federally enforceable controls in place and using either of the procedures below:

- c) The permittee shall determine actual average benzene emissions using the model GRI-GLYCalc™, Version 3.0 or higher, and the procedures presented in the associated GRI-GLYCalc™ Technical Reference Manual. Inputs to the model shall be representative of actual operating conditions of the glycol dehydration unit and may be determined using the procedures documented in the Gas Research Institute (GRI) report entitled "Atmospheric Rich/Lean Method for Determining Glycol Dehydrator Emissions" (GRI-95/0368.1). **(40 CFR 63.772(b)(2)(i))**
 - d) The permittee shall determine an average mass rate of benzene emissions in kilograms per hour through direct measurement using the methods in 40 CFR 63.772(a)(1)(i) or (ii), or an alternative method according to 40 CFR 63.7(f). Annual emissions in kilograms per year shall be determined by multiplying the mass rate by the number of hours the unit is operated per year. This result shall be converted to megagrams per year. **(40 CFR 63.772(b)(2)(ii))**
4. The permittee shall calculate the benzene emission rates from EUDEHY for each calendar month and 12-month rolling time period, using a method acceptable to the AQD District Supervisor. If GRI-GLYCalc (Version 3.0 or higher) is used to calculate the emission rates, the inputs to the model shall be representative of actual operating conditions of EUDEHY and shall include the most recent gas analysis data. The permittee must submit any request for a change in the calculation frequency to the AQD District Supervisor for review and approval. The permittee shall keep records of benzene emission rates on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1225)**
5. The permittee shall keep, in a satisfactory manner, monthly records of the glycol recirculation rate for EUDEHY, as required by SC III.2 and SC VI.2. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.1225, R 336.1702(a), R 336.1901)**
6. The permittee shall keep, in a satisfactory manner, records of the wet gas composition as determined through analysis of wet gas samples for EUDEHY, as required by SC V.1. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.1225, R 336.1702(a), R 336.1901)**
7. If EUDEHY complies with the exemption criteria in 40 CFR 63.764(e)(1)(i) for glycol dehydrators with actual annual average flow rate of natural gas less than 85,000 cubic meters per day, the permittee shall keep records of the actual annual average natural gas throughput (in terms of natural gas flow rate to the glycol dehydration unit per day) as determined in accordance with SC VI.3. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(40 CFR 63.774(d)(1)(i))**
8. As an alternative to SC VI.7, if EUDEHY complies with the exemption criteria in 40 CFR 63.764(e)(1)(ii) for glycol dehydrators with actual average benzene emissions less than 0.90 megagram per year, the permittee shall keep records of the actual average benzene emissions (in terms of benzene emissions per year) as determined in accordance with SC VI.3. The permittee shall keep all records on file at a location approved

by the AQD District Supervisor and make them available to the Department upon request.
(40 CFR 63.774(d)(1)(ii))

VII. REPORTING

1. The permittee shall submit all applicable notifications and reports required by 40 CFR 63.775 by the dates specified in 40 CFR 63.775. (40 CFR 63.775)

VIII. STACK/VENT RESTRICTIONS

The exhaust gases from the stacks listed in the table below shall be discharged unobstructed vertically upwards to the ambient air unless otherwise noted:

Stack & Vent ID	Maximum Exhaust Diameter/ Dimensions (inches)	Minimum Height Above Ground (feet)	Underlying Applicable Requirements
1. SVDEHY	2	16	R 336.1225, R 336.1901

IX. OTHER REQUIREMENTS

NA

Footnotes:

¹This condition is state only enforceable and was established pursuant to Rule 201(1)(b).

FLEXIBLE GROUP SUMMARY TABLE

Flexible Group ID	Flexible Group Description	Associated Emission Unit IDs
FGENGINES	Three natural gas fired reciprocating engines	EUENGINE1, EUENGINE2, EUENGINE3
FGFACILITY	All process equipment source-wide including equipment covered by other permits, grand-fathered equipment and exempt equipment.	

The following conditions apply to: FGENGINES

DESCRIPTION: Three natural gas fired reciprocating engines

Emission Units: EUENGINE1, EUENGINE2, EUENGINE3

POLLUTION CONTROL EQUIPMENT: 3-way catalyst (EUENGINE1 and EUENGINE3)

I. EMISSION LIMITS

Pollutant	Limit	Time Period / Operating Scenario	Equipment	Testing / Monitoring Method	Underlying Applicable Requirements
1. NO _x	7 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE1	SC VI.6 and Appendix A	R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21(c)&(d)
2. CO	13 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE1	SC VI.7 and Appendix A	R 336.1205
3. NO _x	45 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE2	SC VI.6 and Appendix A	R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21(c)&(d)
4. CO	5 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE2	SC VI.7 and Appendix A	R 336.1205
5. NO _x	10 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE3	SC VI.6 and Appendix A	R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21(c)&(d)
6. CO	5 tpy	12-month rolling time period as determined at the end of each calendar month.	EUENGINE3	SC VI.7 and Appendix A	R 336.1205

II. MATERIAL LIMITS

NA

III. PROCESS/OPERATIONAL RESTRICTIONS

1. No later than 60 days after issuance of this permit, the permittee shall submit to the AQD District Supervisor, for review and approval, a preventative maintenance / malfunction abatement plan (PM / MAP) for FGENGINES. After approval of the PM / MAP by the AQD District Supervisor, the permittee shall not operate FGENGINES unless the PM / MAP, or an alternate plan approved by the AQD District Supervisor,

is implemented and maintained. The plan shall incorporate procedures recommended by the equipment manufacturer as well as incorporating standard industry practices. At a minimum the plan shall include:

- a) Identification of the equipment and, if applicable, air-cleaning device and the supervisory personnel responsible for overseeing the inspection, maintenance, and repair
- b) Description of the items or conditions to be inspected and frequency of the inspections or repairs
- c) Identification of the equipment and, if applicable, air-cleaning device, operating parameters that shall be monitored to detect a malfunction or failure, the normal operating range of these parameters and a description of the method of monitoring or surveillance procedures
- d) Identification of the major replacement parts that shall be maintained in inventory for quick replacement
- e) A description of the corrective procedures or operational changes that shall be taken in the event of a malfunction or failure to achieve compliance with the applicable emission limits

If the plan fails to address or inadequately addresses an event that meets the characteristics of a malfunction at the time the plan is initially developed, the owner or operator shall revise the plan within 45 days after such an event occurs and submit the revised plan for approval to the AQD District Supervisor. Should the AQD determine the PM / MAP to be inadequate, the AQD District Supervisor may request modification of the plan to address those inadequacies. (R 336.1205, R 336.1702(a), R 336.1910, R 336.1911, R 336.1912, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

2. The permittee shall not operate any engine equipped with an add-on control device for more than 200 hours per engine per year without that control device consistent with the PM / MAP (pursuant to SC III.1). The 200 hours shall include times after an engine change-out occurs and general maintenance performed as allowed by the PM / MAP. The hours per year limit is based on a 12-month rolling time period as determined at the end of each calendar month. (R 336.1205, R 336.1702(a), R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

IV. DESIGN/EQUIPMENT PARAMETERS

1. The permittee shall not operate any engine that contains an add-on control device unless that device is installed, maintained, and operated in a satisfactory manner, except as specified in SC III.2. Satisfactory operation includes performing the manufacturer's recommended maintenance on the control device and operating in conjunction with the PM / MAP specified in SC III.1. (R 336.1205, R 336.1702(a), R 336.1910, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))
2. The permittee shall install, calibrate, maintain and operate in a satisfactory manner a device to monitor the natural gas usage for each engine included in FGEngines on a continuous basis. (R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

V. TESTING/SAMPLING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

1. Upon request by the AQD District Supervisor, the permittee shall verify NO_x and CO emission factors used to calculate emissions from one or more engine(s) in FGEngines, by testing at owner's expense, in accordance with Department requirements. If a test has been conducted, any resulting increase in an emission factor shall be implemented to calculate NO_x and CO. No less than 60 days prior to testing, the permittee shall submit a complete test plan to the AQD. The AQD must approve the final plan prior to testing. Verification of emission rates includes the submittal of a complete report of the test results to the AQD within 60 days following the last date of the test. (R 336.1205, R 336.2001, R 336.2003, R 336.2004, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))

VI. MONITORING/RECORDKEEPING

Records shall be maintained on file for a period of five years. **(R 336.1201(3))**

1. The permittee shall complete all required calculations in a format acceptable to the AQD District Supervisor and make them available by the last day of the calendar month, for the previous calendar month, unless otherwise specified in any monitoring/recordkeeping special condition. **(R 336.1205, R 336.1702(a), R 336.1901)**
2. The permittee shall monitor, in a satisfactory manner, the natural gas usage for each engine included in FGEngines on a continuous basis. **(R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
3. The permittee shall maintain a log of all maintenance activities conducted according to the PM / MAP (pursuant to SC III.1). The permittee shall keep this log on file at a location approved by the AQD District Supervisor and make it available to the Department upon request. **(R 336.1205, R 336.1702(a), R 336.1911, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
4. The permittee shall keep, in a satisfactory manner, for any engine equipped with an add-on control device, monthly and 12-month rolling time period records of the hours that the engine is operated without the control device. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.1702(a), R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
5. The permittee shall keep, in a satisfactory manner, monthly fuel use records for each engine included in FGEngines, as required by SC VI.2. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
6. The permittee shall keep, in a satisfactory manner, monthly and 12-month rolling time period NO_x emission calculation records for each engine included in FGEngines, as required by SC I.1, I.3, I.5, and Appendix A. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**
7. The permittee shall keep, in a satisfactory manner, monthly and 12-month rolling time period CO emission calculation records for each engine included in FGEngines, as required by SC I.2, I.4, I.6, and Appendix A. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. **(R 336.1205)**

VII. REPORTING

1. Except as provided in R 336.1285, if any engine included in FGEngines is replaced with an equivalent-emitting or lower-emitting engine, the permittee shall notify the AQD District Supervisor of such change-out and submit acceptable emissions data to show that the alternate engine is equivalent-emitting or lower-emitting. The data shall be submitted within 30-days of the engine change out. **(R 336.1205, R 336.1702(a), R 336.1911, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d))**

VIII. STACK/VENT RESTRICTIONS

The exhaust gases from the stacks listed in the table below shall be discharged unobstructed vertically upwards to the ambient air unless otherwise noted:

Stack & Vent ID	Maximum Exhaust Diameter/ Dimensions (inches)	Minimum Height Above Ground (feet)	Underlying Applicable Requirements
1. SVENGINE1	8	36	R 336.1225, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d)
2. SVENGINE2	8	45	R 336.1225, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d)
3. SVENGINE3	8	36	R 336.1225, R 336.2803, R 336.2804, 40 CFR 52.21 (c) & (d)

IX. OTHER REQUIREMENTS

1. The permittee shall comply with all provisions of the National Emission Standards for Hazardous Air Pollutants as specified in 40 CFR Part 63 Subparts A and ZZZZ, as they apply to FGEngines. **(40 CFR Part 63 Subparts A & ZZZZ)**

Footnotes:

¹This condition is state only enforceable and was established pursuant to Rule 201(1)(b).

The following conditions apply Source-Wide to: FGFACILITY

I. EMISSION LIMITS

Pollutant	Limit	Time Period / Operating Scenario	Equipment	Testing / Monitoring Method	Underlying Applicable Requirements
1. NO _x	65 tpy	12-month rolling time period as determined at the end of each calendar month.	FGFACILITY	SC VI.2 and Appendix A	R 336.1205(3)
2. Benzene	250 lb/yr	12-month rolling time period as determined at the end of each calendar month.	FGFACILITY	SC VI.2	R 336.1225

II. MATERIAL LIMITS

1. The permittee shall not burn any sour natural gas in FGFACILITY. Sour gas is defined as any gas containing more than 1 grain of hydrogen sulfide or more than 10 grains of total sulfur per 100 standard cubic feet. (R 336.1205(3))

III. PROCESS/OPERATIONAL RESTRICTIONS

1. The permittee shall comply with all provisions, including recordkeeping and reporting, of the federal Standards of Performance for New Stationary Sources as specified in 40 CFR Part 60 Subparts A and KKK, as they apply to FGFACILITY. (40 CFR Part 60 Subparts A & KKK)
2. The permittee shall comply with all provisions of the National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 63, Subpart HH, as they apply to FGFACILITY. (40 CFR Part 63, Subpart HH)

IV. DESIGN/EQUIPMENT PARAMETERS

NA

V. TESTING/SAMPLING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

1. Verification of H₂S and/or sulfur content of the natural gas burned in FGFACILITY may be required upon request by the AQD District Supervisor. This condition is necessary to ensure compliance with SC II.1. (R 336.1205(3))

VI. MONITORING/RECORDKEEPING

Records shall be maintained on file for a period of five years. (R 336.1201(3))

1. The permittee shall complete all required calculations in a format acceptable to the AQD District Supervisor and make them available by the last day of the calendar month, for the previous calendar month, unless otherwise specified in any monitoring/recordkeeping special condition. (R 336.1205(3), R 336.1225)

2. The permittee shall keep, in a satisfactory manner, monthly and 12-month rolling time period NO_x and benzene emission calculation records for FGFACILITY, as required by SC I.1, SC I.2, and Appendix A. The permittee shall keep all records on file at a location approved by the AQD District Supervisor and make them available to the Department upon request. (R 336.1205(3), R 336.1225)

VII. REPORTING

NA

VIII. STACK/VENT RESTRICTIONS

NA

IX. OTHER REQUIREMENTS

NA

Footnotes:

¹This condition is state only enforceable and was established pursuant to Rule 201(1)(b).

APPENDIX A
Procedures for Calculating NO_x and CO Emissions

The permittee shall demonstrate compliance with the NO_x and CO emission limits by keeping track of all fuel usage for all equipment using such fuel at this facility and multiplying that fuel usage by an equipment-specific emission factor. The emission factors are typically expressed as the mass of pollutant per unit of fuel.

Each engine included in FGENGINES:

The permittee shall use emission factors from vendor data or from source specific testing (stack testing), as available for each engine included in FGENGINES. This also applies to engine(s) from engine change-out(s). If emission factors from other sources are used, the permittee shall obtain the approval of the AQD District Supervisor before using the emission factors to calculate emissions.

Fuel burning equipment at the facility:

The permittee shall use emission factors contained in the most recent AP-42 (Compilation of Air Pollutant Emission Factors) or the most recent FIRE (Factor Information Retrieval) database if vendor or stack testing data is not available. If emission factors from other sources are used, the permittee shall obtain the approval of the AQD District Supervisor before using the emission factors to calculate emissions.

The permittee shall document the source of each emission factor used in the calculations.

Preventative Maintenance / Malfunction Abatement Plan (PM / MAP)
Content Checklist for Engines Required to Submit a PM / MAP

PM / MAP Content		Location	
		Page	Section / Table
1	Contact Person		
Engines			
2	Engine Identification: Include the engine make / model and type of engine (i.e. rich or lean burn). Identify engines with add on control and AFRC. If add on control is present, identify type of control.		
3	Engine Operating Variables To Be Monitored. Include a copy of the normal engine maintenance log.		
4	Corrective procedures or operational changes that will be taken in the event of a malfunction.		
5	Major parts replacement inventory for engines.		
Add-On Controls			
6	Catalytic Converter operating variables to be monitored. Include the method and frequency of monitoring these variables; provide the normal operating range of these variables.		
7	Corrective actions to be taken in event of malfunction of the catalytic converter.		
8	AFRC O ₂ Sensor replacement schedule or operating variables to be monitored		
9	Corrective actions to be taken in event of malfunction of the AFRC		
10	Emission testing utilizing portable analyzer		
11	Scheduled maintenance of control equipment		
12	Major parts replacement inventory for add on control.		
13	Identify supervisory personnel responsible for overseeing inspection, maintenance and repair of add on controls.		
14	Recordkeeping and retention of records.		
15	Updates of PM / MAP as necessary.		

**Guidance Document For
Preventative Maintenance / Malfunction Abatement Plan (PM / MAP) Checklist**

1. Contact Person: Include the name, title, telephone number (extension if applicable) and e-mail address for the person that may be contacted with questions regarding this Preventative Maintenance / Malfunction Abatement Plan (PM / MAP) with the transmittal letter accompanying the PM / MAP rather than within the body of the PM / MAP.

Engines

2. Engine Identification: For each engine at the facility, list the engine manufacturer, model and type of engine (rich burn or lean burn) and the type of add-on control equipment used (oxidation catalyst, three-way catalyst), if any. Also, identify each engine with an air to fuel ratio controller (AFRC).
3. Engine operating variables to be monitored: Provide the normal engine maintenance log.
4. Corrective procedures in the event of an engine malfunction: Provide a brief summary of the procedures that will take place in the event of an engine malfunction. A malfunction is defined in Rule 113(d) of the State of Michigan Air Pollution Control Rules which states, in part, 'any sudden, infrequent and not reasonable preventable failure of the equipment to operate in a normal or usual manner. Failures caused in part by poor maintenance or careless operations are not malfunctions.'
5. Major parts replacement inventory: Provide a list of major replacement parts that shall be maintained in inventory for quick replacement. If no replacement parts are kept on site provide a statement that no parts shall be kept.

Add-On Controls

6. Catalytic converter operating variables to be monitored: Provide the following:
 - a. A list of variables that will be monitored to measure catalytic converter performance including the catalytic converter inlet and outlet temperature, pressure differential across the catalytic converter, and any other relevant catalytic converter variables that are monitored.
 - b. The normal operating range that has been developed for each variable; acceptable ranges shall include documentation as to how the range was determined (i.e. manufacturer's recommendations or determined in the field with documentation or testing).
 - c. The method of monitoring the variables, and
 - d. The frequency of monitoring the variables.
7. Corrective procedures in the event of a malfunction of the catalytic converter: Malfunction is defined in number four above. Provide information on what steps shall be taken when a variable is out of range. This could include monitoring of emissions or cleaning and/or replacement of the catalytic converter.
8. AFRC O₂ sensor replacement schedule or operating variables to be monitored: Chose either (a) or (b).
 - a. O₂ sensor replacement interval or sensor life detector
 - b. If monitoring, provide:
 - i. A list of variables monitored to measure AFRC performance (i.e. millivolt output, O₂, and/or any other relevant AFRC variables that are monitored).
 - ii. The normal operating range that has been developed for each variable; acceptable ranges shall include documentation as to how the range was determined (i.e. manufacturer's recommendations or determined in the field with documentation or testing).
 - iii. The method of monitoring the variables.
 - iv. The frequency of monitoring the variables.
9. Corrective procedures in the event of a malfunction of the AFRC: Malfunction is defined in number 4 above. If choosing monitoring in paragraph 8.b above, provide information on what steps shall be taken when a variable is out of range.

10. Emission checks: Describe when a portable analyzer would be used and how it will be used.
 - a. Calibration of the analyzer will be conducted as required by manufacturer's specifications. Records shall be kept on file and made available to the Air Quality Division upon request.
 - b. Checks for both CO and NO_x.
 - c. Checks to be used to:
 - i. Check performance if monitored parameter is out of normal range, e.g. low inlet temperature (an engine specific minimum inlet temperature could then be established).
 - ii. When vendor cleaned catalyst is installed. This check will normally occur in the 12-18 month window as specified for routine cleaning.
 - d. Companies may choose to perform any of following the three valid methods:
 - i. Inlet and outlet checks and estimate destruction efficiency.
 - ii. Outlet testing and check for g/hp-hr compared to levels used for permitting.
 - iii. Outlet testing and use the uncontrolled vendor data to establish destruction efficiency.
11. Scheduled maintenance: Describe the scheduled cleaning and/or replacement of the catalytic converter.
 - a. Frequency of catalytic converter inspection and field catalyst media cleaning (vacuum catalyst face): Follow vendor recommendations, typically 12-18 months unless parameters (pressure drop, temperature deviations, etc) indicate otherwise.
 - b. Catalyst media removal and wash in chemical solution by manufacturer (if catalyst media does not respond to field cleaning). A replacement catalyst media will be used during the cleaning process.
 - c. Catalytic converter gasket replacement: Follow vendor recommendations, typically 12-18 months when catalyst is serviced.
 - d. Replace catalyst media if not functioning properly after vendor cleaning, or in lieu of vendor cleaning.
12. Major parts replacement inventory: Provide a list of major replacement parts that shall be maintained in inventory for quick replacement. If no replacement parts are kept on site provide a statement that no parts shall be kept.
13. Supervisory personnel responsible for maintenance of the control equipment: Include the contact information. This person or position can be a company employee or contractor and may or may not be the same person / position listed in number one above.
14. Retention of records: Records shall be kept on file and retained as described in the permit.
15. Updates of PM / MAP: Any updates to the plan shall be submitted to the AQD District Supervisor for written approval as required in the permit (the Department of Environmental Quality recommends the PM / MAP be reviewed annually).



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY - AIR QUALITY DIVISION
PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE
APPLICATION NUMBER
121-11A

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at <http://www.deq.state.mi.us/aps>. Please call the AQD at 517-373-7023 if you have not been contacted within 15 days of your application submittal.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)						
SRN	P	0	2	6	0	
NAICS	2	2	1	2	1	0
2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency)						
Savoy Energy L.P. (Goetz 8 Trust CPF)						
3. APPLICANT ADDRESS: (Number and Street)				MAIL CODE:		
POB 1560						
CITY: (City, Village or Township)			STATE:	ZIP CODE:	COUNTY:	
Traverse City			MI	49685-1560	Grand Traverse	
4. EQUIPMENT OR PROCESS LOCATION: (Number and Street - If different than Item 3)						
Sec. 8, Lat.: 41 58' 16.035" - Long.: 84 05' 40.200"						
CITY: (City, Village or Township)			ZIP CODE:	COUNTY:		
Adrian Township			49221	Lenawee		
5. GENERAL NATURE OF BUSINESS:						
Oil & Natural Gas Production/Transportation						
6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.)						
Title V Opt-Out (Synthetic Minor)						
Existing Permitted Equipment:						
EU00001 - CAT 398 N/G Compressor Engine (2-02-00-53).						
EU00002 - Dehydrator Reboiler (3-10-003-21 Trenton/Black River).						
Proposed Additional Equipment						
EU00003 - CAT 3406 N/G Compressor Engine (2-02-00-53).						
EU00004 - Cummings GTA 19 N/G Generator Engine (2-02-00-53).						
Exempt Equipment						
A complete emission inventory of all sources can be found in the attached supporting information.						
7. REASON FOR APPLICATION: (Check all that apply.)						
<input type="checkbox"/> INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS						
<input checked="" type="checkbox"/> RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS - DATE TO INSTALL: Dec 15, 2011						
<input type="checkbox"/> OTHER - DESCRIBE						
8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S): 121-11						
9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? <input checked="" type="checkbox"/> NOT APPLICABLE <input type="checkbox"/> PENDING APPLICATION <input type="checkbox"/> YES						
PENDING APPLICATION OR ROP NUMBER:						
10. AUTHORIZED EMPLOYEE:			TITLE: CEO of Savoy Exploration Inc.		PHONE NUMBER: (Include Area Code)	
Thomas C. Pangborn					(231) 941-9552	
SIGNATURE:			DATE:		E-MAIL ADDRESS	
			11/2/11		barb@savoyexp.com	
11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application)			PHONE NUMBER: (Include Area Code)		E-MAIL ADDRESS:	
Wayne Cockrum			231 946 8200		wcockrum@ectinc.com	
CONTACT AFFILIATION:						
Consultant						
12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO						
FOR DEQ USE ONLY - DO NOT WRITE BELOW						
DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: 12/5/11						
DATE PERMIT TO INSTALL APPROVED: 12/7/11			SIGNATURE: MaryAnn Dolhanty			
DATE APPLICATION / PTI VOIDED:			SIGNATURE:			
DATE APPLICATION DENIED:			SIGNATURE:			
A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL						

RECEIVED

NOV 03 2011

AIR QUALITY DIV.



PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE
APPLICATION NUMBER

121-11

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at <http://www.deq.state.mi.us/aps>. Please call the AQD at 517-373-7023 if you have not been contacted within 15 days of your application submittal.

RECEIVED

JUL 29 2011

AIR QUALITY DIV.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)												
SRN	P	C	2	6	C	NAICS	2	1	1	1	1	1
2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency) Savoy Energy, L.P.												
3. APPLICANT ADDRESS: (Number and Street) P.O. Box 1560								MAIL CODE:				
CITY: (City, Village or Township) Traverse City						STATE: MI		ZIP CODE: 49685-1560		COUNTY: Grand Traverse		
4. EQUIPMENT OR PROCESS LOCATION: (Number and Street - if different than Item 3) Sec. 8, T6S-R3E, Adrian Twp.												
CITY: (City, Village or Township) Adrian						ZIP CODE: 49221		COUNTY: Lenawee				
5. GENERAL NATURE OF BUSINESS: Oil and gas production												
6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.) Crude oil, natural gas, and brine fluids are produced from wells drilled into producing reservoirs. The fluids are transported via flow lines to a central processing facility that separates the oil, natural gas, and water and stores and/or further processes the gas and liquids for sale or disposal. The produced oil and gas and water entering the facility passes through a line heater and heater treater to separate the oil, water, and gas. The gas is compressed using a natural gas fired reciprocating internal combustion engine (EUENGINE1), and dried through a triethylene glycol dehydrator (EUDEHY) prior to entering a sales pipeline.												
7. REASON FOR APPLICATION: (Check all that apply.) <input checked="" type="checkbox"/> INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS <input type="checkbox"/> RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS - DATE INSTALLED: <input type="checkbox"/> OTHER - DESCRIBE												
8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S):												
9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? <input checked="" type="checkbox"/> NOT APPLICABLE <input type="checkbox"/> PENDING APPLICATION <input type="checkbox"/> YES PENDING APPLICATION OR ROP NUMBER:												
10. AUTHORIZED EMPLOYEE: Thomas C. Pangborn SIGNATURE:						TITLE: CEO of Savoy Exploration, Inc. DATE: 7-27-11			PHONE NUMBER: (Include Area Code) 231-941-9552 E-MAIL ADDRESS: barb@savoyexp.com			
11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application) Stephen Niehaus, P.E.						CONTACT AFFILIATION: Niehaus Environmental Engineering, LLC			E-MAIL ADDRESS: niehaus-eng@charter.net			
12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO												
FOR DEQ USE ONLY - DO NOT WRITE BELOW												
DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: 8/11/11												
DATE PERMIT TO INSTALL APPROVED: 9/14/11						SIGNATURE: MaryAnn Dieckman						
DATE APPLICATION / PTI VOIDED: 12/7/11						SIGNATURE: MaryAnn Dieckman						
DATE APPLICATION DENIED:						SIGNATURE:						
A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL												

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

September 14, 2011

PERMIT TO INSTALL
121-11


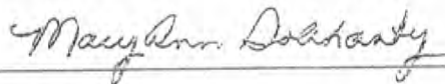
ISSUED TO
Savoy Energy, LP

LOCATED AT
Section 8
Adrian Township, Michigan

IN THE COUNTY OF
Lenawee

STATE REGISTRATION NUMBER
P0260

The Air Quality Division has approved this Permit to Install, pursuant to the delegation of authority from the Michigan Department of Environmental Quality. This permit is hereby issued in accordance with and subject to Section 5505(1) of Article II, Chapter I, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Pursuant to Air Pollution Control Rule 336.1201(1), this permit constitutes the permittee's authority to install the identified emission unit(s) in accordance with all administrative rules of the Department and the attached conditions. Operation of the emission unit(s) identified in this Permit to Install is allowed pursuant to Rule 336.1201(6).

DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203: August 11, 2011	
DATE PERMIT TO INSTALL APPROVED: September 14, 2011	SIGNATURE: 
DATE PERMIT VOIDED: December 7, 2011	SIGNATURE: 
DATE PERMIT REVOKED:	SIGNATURE:



PERMIT TO INSTALL APPLICATION

For authority to install, construct, reconstruct, relocate, or modify process, fuel-burning or refuse burning equipment and/or control equipment. Permits to install are required by administrative rules pursuant to Section 5505 of 1994 PA 451, as amended.

FOR DEQ USE
APPLICATION NUMBER

Please type or print clearly. The "Application Instructions" and "Information Required for an Administratively Complete Permit to Install Application" are available on the Air Quality Division (AQD) Permit Web Page at <http://www.deq.state.mi.us/aps>. Please call the AQD at 517-373-7023 if you have not been contacted within 15 days of your application submittal.

1. FACILITY CODES: State Registration Number (SRN) and North American Industry Classification System (NAICS)												
SRN	P	0	2	6	0	NAICS	2	2	1	2	1	0
2. APPLICANT NAME: (Business License Name of Corporation, Partnership, Individual Owner, Government Agency) Savoy Energy L.P. (Goetz 8 Trust CPF)												
3. APPLICANT ADDRESS: (Number and Street) POB 1560										MAIL CODE:		
CITY: (City, Village or Township) Traverse City							STATE: MI		ZIP CODE: 49685-1560		COUNTY: Grand Traverse	
4. EQUIPMENT OR PROCESS LOCATION: (Number and Street - if different than Item 3) Sec. 8, Lat.: 41 58' 16.035" - Long.: 84 05' 40.200"												
CITY: (City, Village or Township) Adrian Township							ZIP CODE: 49221		COUNTY: Lenawee			
5. GENERAL NATURE OF BUSINESS: Oil & Natural Gas Production/Transportation												
6. EQUIPMENT OR PROCESS DESCRIPTION: (A Description MUST Be Provided Here. Include Emission Unit IDs. Attach additional sheets if necessary; number and date each page of the submittal.) Title V Opt-Out (Synthetic Minor) Existing Permitted Equipment: EU00001 - CAT 398 N/G Compressor Engine (2-02-00-53). EU00002 - Dehydrator Reboiler (3-10-003-21 Trenton/Black River). Proposed Additional Equipment EU00003 - CAT 3406 N/G Compressor Engine (2-02-00-53). EU00004 - Cummings GTA 19 N/G Generator Engine (2-02-00-53). Exempt Equipment A complete emission inventory of all sources can be found in the attached supporting information.												
7. REASON FOR APPLICATION: (Check all that apply.) <input type="checkbox"/> INSTALLATION / CONSTRUCTION OF NEW EQUIPMENT OR PROCESS <input checked="" type="checkbox"/> RECONSTRUCTION / MODIFICATION / RELOCATION OF EXISTING EQUIPMENT OR PROCESS - DATE TO INSTALL: Dec 15, 2011 <input type="checkbox"/> OTHER - DESCRIBE												
8. IF THE EQUIPMENT OR PROCESS THAT WILL BE COVERED BY THIS PERMIT TO INSTALL (PTI) IS CURRENTLY COVERED BY ANY ACTIVE PERMITS, LIST THE PTI NUMBER(S): 121-11												
9. DOES THIS FACILITY HAVE AN EXISTING RENEWABLE OPERATING PERMIT (ROP)? <input checked="" type="checkbox"/> NOT APPLICABLE <input type="checkbox"/> PENDING APPLICATION <input type="checkbox"/> YES PENDING APPLICATION OR ROP NUMBER:												
10. AUTHORIZED EMPLOYEE: Thomas C. Pangborn							TITLE: CEO of Savoy Exploration Inc.			PHONE NUMBER: (Include Area Code) (231) 941-9552		
SIGNATURE:							DATE: 11/2/11			E-MAIL ADDRESS barb@savoyexp.com		
11. CONTACT: (If different than Authorized Employee. The person to contact with questions regarding this application) Wayne Cockrum							PHONE NUMBER: (Include Area Code) 231 946 8200			E-MAIL ADDRESS: wcockrum@ectinc.com		
CONTACT AFFILIATION: Consultant												
12. IS THE CONTACT PERSON AUTHORIZED TO NEGOTIATE THE TERMS AND CONDITIONS OF THE PERMIT TO INSTALL? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO												
FOR DEQ USE ONLY - DO NOT WRITE BELOW												
DATE OF RECEIPT OF ALL INFORMATION REQUIRED BY RULE 203:												
DATE PERMIT TO INSTALL APPROVED:							SIGNATURE:					
DATE APPLICATION / PTI VOIDED:							SIGNATURE:					
DATE APPLICATION DENIED:							SIGNATURE:					
A PERMIT CERTIFICATE WILL BE ISSUED UPON APPROVAL OF A PERMIT TO INSTALL												

PERMIT TO INSTALL
SAVOY ENERGY
GOETZ 8 Trust CPF
OIL & GAS PRODUCTION FACILITY
SUPPORTING INFORMATION

Table of Contents

1.0	Process Description
1.1	General
1.2	Natural Gas Compressor Engine
1.3	Generator Engine
2.0	Emissions
2.1	Engine Emissions
2.2	Dehydrator Reboiler
2.3	Dehydrator Burner
2.4	Line heaters
2.5	Heater Treaters
2.6	Oil tanks
2.7	Truck Loadouts
2.8	Emergency Flare
2.9	Fugitive Emissions
3.0	Regulatory Discussion
3.1	State and Federal Regulations
3.2	Title V Renewable Operating Permit Applicability
4.0	Control Technology Analysis
4.1	Generator Engine - Cummings GTA19
4.2	Compressor Engine - CAT 3406 NA
4.3	Dehydrator Reboiler
4.4	Heaters/Burners
4.5	Crude Oil Storage Tanks
5.0	Stack Parameters
6.0	Emission Calculations
6.1	Calculation of Potential Emissions from Natural Gas Engines (3)
6.1.1	CAT 398
6.1.2	Cat 3406
6.1.3	Cummings GTA19
6.2	Calculation of Potential Emissions from Glycol Dehydrator Reboiler
6.3	Calculation of Potential Emissions Dehydrator Burner, Line Heaters, Heater Treaters, & Emergency Flare
6.4	Fugitive Emissions

Tables

<u>Appendix</u>	<u>Title</u>
A	Site Plan (Figure 1)
B	Emission Data, (Vendor) Equipment Drawings
C	MDEQ, Air Quality Division Fact Sheet
D	GLYCalc Report
E	Variance to Rule 225

GOETZ 8 TRUST CENTRAL PROCESSING FACILITY (CPF)
SUPPORTING INFORMATION

INTRODUCTION

Savoy Energy is requesting a Permit to Install modification for the Goetz 8 CPF. The requested permit would allow the operation of two additional natural gas fired engines. This facility was issued a permit (PTI # 121-11), September 14, 2011, for one compressor engine and a dehydrator unit. This modification would allow one additional compressor engine and one additional generator engine. Emissions for both engines are depicted within this supporting information.

As necessary to determine Title V, Renewable Operating Permit (ROP) applicability, emissions from the new sources were tallied and combined with the existing permitted sources and also the existing exempt sources. Total NOx emissions from all sources now exceed the Title V threshold of 100 tons. Total emissions for the other criteria pollutants and hazardous air pollutants remain below the ROP threshold. See Table 2.6 for a complete emission inventory.

Savoy is requesting to opt-out of the Title V, ROP program by restricting NOx emissions to levels below the Title V threshold. This restriction will be achieved by installing a catalytic converter on the proposed Cummings GTA19 generator engine and retaining the catalytic converter on the currently permitted CAT 398 compressor engine.

Subject facility is located in Section 8, T6S-R3E, Adrian Township, Lenawee County, Michigan.

1.0 PROCESS DESCRIPTION

1.1 General

Natural gas and oil from wells is passed through field separators, heaters, a dehydrator and a compression system at the CPF to remove hydrocarbon condensate, water, and to control gas pressure necessary for further pipeline transport. The additional equipment will allow the plant to also generate its own electricity and also allow an operation that will have the ability to remove unwanted nitrogen from the raw gas.

The emission sources in the new process will now require two compressor engines, a generator, a glycol dehydrator reboiler, a dehydrator burner, four line heaters, four heater-treaters, an emergency flare, four 400 barrel oil tanks and fugitive emissions associated with loadouts and pipe fittings. Each emission source will be detailed in this process description.

**1.2 Natural Gas Engines – EU00001, EU00002, & EU00003
(SCC Number: 2-02-002-53)**

The primary emission sources at subject oil and gas production facility are the natural gas-fired engines (3). One of engines is used to power compressors to facilitate further pipeline transportation. A second engine will be used to help remove nitrogen from the raw gas. And, a third engine will generate electricity for the facility. No electricity will be sold to any third party for any purpose.

Subject engines are all fueled by non-processed natural gas.

The three natural gas-fired engines required at site is one, 4-stroke, 600 HP, CAT 398 NA, compressor engine (currently permitted), one 215 HP, Cat 3406 NA compressor engine (proposed) and one 495 HP, Cummings GTA19 genset. The engines are designed, and will operate 24 hours per day, 365 days per year. Engine emission specifications are listed in Appendix B.

1.3 Gas Dehydration (SCC 3-10-003-23 and SCC 3-10-002-27)

Emissions from the dehydrator have been addressed in the original permit. (See permit no. 121-11).

2.0 EMISSIONS

2.1 Engine Emissions

The primary pollutants of concern from natural gas fired engines are the oxides of nitrogen (NO_x), Volatile Organic Compounds (VOCs), and Carbon Monoxide (CO) which readily forms in the high-temperature, pressure, and excess air environment found in gas firing engine processes. Natural gas fueled engines, particularly reciprocating engines emit significantly more of these pollutants than do external combustion burners.

Major emission variables are also associated with natural gas-fired engines and can include air/fuel ratio, engine load (defined as the ratio of the operating horsepower to rated horsepower), intake manifold air temperature, and absolute humidity. NO_x emissions along with all the other regulated criteria compounds for the engine are tabulated in Tables 2.1 and 2.2.

- Compressor Engine - Caterpillar 398 NA 600 hp (permitted)

UNCONTROLLED

NO_x – 12.42 lb/hr, 54.4 tons/yr *

CO – 13.08 lb/hr, 57.3 tons/yr *

HC – 2.12 lb/hr, 9.3 tons/yr *

CONTROLLED

NO_x – 1.24 lb/hr, 5.44 tons/yr **

CO – 2.62 lb/hr, 11.48 tons/yr **

HC – 1.06 lb/hr, 4.64 tons/yr **

* Note: Emission factors supplied by Vendor (attached).

** Note: Control efficiency supplied by MDEQ Emission Calculation Fact Sheet #9845.

NO_x: 90% Reduction

CO: 80% Reduction

VOC: 50% Reduction

- Compressor Engine - Caterpillar 3406 NA 215 hp (not yet permitted)

Uncontrolled

NO_x – 10.14 lb/hr, 44.4 tons/yr *

CO – 0.66 lb/hr, 2.91 tons/yr *

HC – 0.66 lb/hr, 2.91 tons/yr

- Genset - Cummings GTA19, 495 hp (not yet permitted)

UNCONTROLLED

NO_x – 17.22 lb/hr, 75.42 tons/yr *

CO – 0.40 lb/hr, 1.77 tons/yr *

HC – 2.56 lb/hr, 11.23 tons/yr *

CONTROLLED

NO_x – 1.72 lb/hr, 7.54 tons/yr **

CO – 0.08 lb/hr, 0.35 tons/yr **

HC – 1.28 lb/hr, 5.62 tons/yr **

* Note: Emission factors supplied by Vendor (attached).

** Note: Control efficiency supplied by MDEQ Emission Calculation Fact Sheet #9845.

NO_x: 90% Reduction

CO: 80% Reduction

VOC: 50% Reduction

2.2 Glycol Dehydrator Reboiler (1)

VOCs emissions from the dehydrator reboiler are based on a GLYCalc4 report dated 7/25/11 (Appendix D). The current permit (#121-11) allows for 250 pounds benzene/year. Savoy Energy is not asking for any variance to the existing permit.

2.3 Glycol Dehydrator Burner (1)

Fuel Gas volume (250,000 BTU/HR) / (1,000 btu/ft³) = 250 ft³/hr
 (250 ft³/hr) / (1,000,000 ft³) x 140 NO_x = 0.035 lbs/hr or 308 lbs/yr NO_x

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.4 Line heaters (4)

Fuel Gas volume (500,000 BTU/HR) / (1,000 btu/ft³) = 500 ft³/hr
 (500 ft³/hr) / (1,000,000 ft³) x 140 NO_x = 0.07 lbs/hr or 616 lbs/yr NO_x

Total all four heaters: 2464 lbs/yr NO_x

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.5 Heater Treaters (4)

Fuel Gas volume (500,000 BTU/HR) / (1,000 btu/ft³) = 500 ft³/hr
(500 ft³/hr) / (1,000,000 ft³) x 140 NO_x = 0.07 lbs/hr or 616 lbs/yr NO_x

Total all four heaters: 2464 lbs/yr NO_x

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.6 Oil Tanks - 400 Barrels (4)

Uncontrolled Fixed Roof Breathing Loss

Storage Capacity 400 bbl x 4 tanks = 1600 bbls or 67200 gallons crude.
VOCs = 3.6E1 LB/KGAL-Yr Crude Oil (Storage Capacity)
VOCs = 36 x 67200 gallons ÷ 1000 = 2419 LB

Controlled Fixed Roof Breathing Loss

Storage Capacity 400 bbl x 4 tanks = 1600 bbls or 67200 gallons crude.
VOCs = 3.6E1 LB/KGAL-Yr Crude Oil (Storage Capacity)
VOCs = 36 x 67200 gallons ÷ 1000 = 2419 LBS
Controlled VOCs = 95% reduction or 120.96 LBS

Uncontrolled Fixed Roof Working Loss

Storage Capacity 400 bbl x 4 tanks = 1600 bbls or 67200 gallons crude.
VOCs = 1.1E0 LB/E3 Gal Crude Oil (Annual Throughput))
VOCs = 1.1 x 6.13 mm gallons/yr ÷ 1000 = 6743 LB

Controlled Fixed Roof Working Loss

Storage Capacity 400 bbl x 4 tanks = 1600 bbls or 67200 gallons crude.
VOCs = 1.1E0 LB/E3 Gal Crude Oil (Annual Throughput))
VOCs = 1.1 x 6.13 mm gallons/yr ÷ 1000 = 6743 LB
Controlled VOCs = 95% reduction or 337 LBS

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.7 Truck Loadouts (2)

Crude Oil Throughput: 146000 bbls/yr or 6.13 mmgallons/yr
VOCs = 2.0E0 LB/E3 Gallons Crude Oil
VOCs = 12260 lbs/yr or 6.13 tons/yr

* Note: Emission factor supplied by MDEQ, AQD, Fact Sheet #9845

2.8 Emergency Flare

Throughput from oil tanks: 26 ft³/hr

$(26 \text{ ft}^3/\text{hr}) / (1,000,000 \text{ ft}^3) \times 140 \text{ NOx} = 0.004 \text{ lbs/hr or } 32 \text{ lbs/yr NOx}$

2.9 Fugitive Emissions

Emissions that are not, and cannot be contained or collected, and emitted through a stack or vent are defined as fugitive. Examples of fugitive emission sources would be: flanges, connectors, valves, pumps, regulators etc. associated with gas compression and the natural gas flow process at subject site. Although the number of fugitive emission sources have not been counted at subject site it can be assumed, based on counts at similar sites, that the number of fugitive sources at subject site is significantly below, or <100 valves, <100 connectors, and <100 flanges. Based on these counts fugitive emissions will be less than the following:

Equipment	E-Factor: lb/hr/source	Count	VOC Emissions lbs/hr	VOC Emissions lbs/yr
Flange	0.0000924*	<100	<0.00924	<80.94
Valve	0.0000286*	<100	<0.00286	<25.05
Connectors	0.0000924*	<100	<0.00924	<80.94
Totals			<0.02134	<186.93

*Emission Factors from EPA-453/R-95-017

Cumulative emissions from all sources including Fugitive are depicted in Table 2.4

3.0 REGULATORY DISCUSSION

3.1 State and Federal Regulations

Compressor Engine CAT 398 NA

State Exemptions

The CAT 398 NA compressor engine has a maximum heat input less than 10,000,000 BTU per hour, which qualifies it for exemption under Michigan Air Quality Division (AQD) Rule 336.1285(g). AQD R336.1278 however, requires a permit if actual emissions from any activity exceeds significant levels (40 tons/year NOx or 40 tons/year CO). A **permit to install is required** for subject compressor engine, but is not subject to major source fees. The allowable emissions may be determined as necessary by dispersion modeling of the ambient impact, or as directed by AQD staff.

NSPS, Subpart JJJJ

Cat 398 NA engine is not subject to NSPS Subpart JJJJ. Subject engine was constructed prior to June 1, 2007. See rule 60.4230(a)(4).

NESHAP, Subpart ZZZZ

Cat 398 NA engine is subject to NESHAP Subpart ZZZZ, for HAP area sources and will be subject to emission limitations beginning October 19, 2013. (See Rule 63.6595)

AQD, R336.1224

Cat 398 NA engine is subject to Rule 336.1224 (2)(c) - Best Available Control Technology for Toxics (T-BACT) is not warranted however when in compliance with Best Available Control Technology (BACT). BACT is acceptable when the emissions levels are very low or insignificant and the cost to remove these emissions is very high, therefore the CAT 398 NA is in compliance with BACT.

AQD, R336.1225

CAT 398 NA engine is not subject to Rule 336.1225 if the associated stack is greater than 1.5 times the building height (MDEQ, Air Quality Division Variance, effective date 1/21/10 ((Appendix E)). The stack at this site will be constructed at a height greater than 1.5 times the building height.

AQD, R336.1702

CAT 398 NA engine is subject to Rule 336.1702 - Emissions are based on a determination of BACT. This engine meets BACT requirements based on insignificant emissions as described above.

Compressor Engine CAT 3406 NA

State Exemptions

The CAT 3406 NA compressor engine has a maximum heat input less than 10,000,000 BTU per hour, which qualifies it for exemption under Michigan Air Quality Division (AQD) Rule 336.1285(g). AQD R336.1278 however, requires a permit if actual emissions from any activity exceeds significant levels (40 tons/year NOx or 40 tons/year CO). A permit to install is required for subject compressor engine, but is not subject to major source fees. The allowable emissions may be determined as necessary by dispersion modeling of the ambient impact, or as directed by AQD staff.

NSPS, Subpart JJJJ

Cat 3406 NA engine is not subject to NSPS Subpart JJJJ. Subject engine was constructed prior to June 1, 2007. See rule 60.4230(a)(4).

NESHAP, Subpart ZZZZ

Cat 3406 NA engine is subject to NESHAP Subpart ZZZZ, for HAP area sources and will be subject to emission limitations beginning October 19, 2013. (See Rule 63.6595)

AQD, R336.1224

Cat 3406 NA engine is subject to Rule 336.1224 (2)(c) - Best Available Control Technology for Toxics (T-BACT) is not warranted when in compliance with Best Available Control Technology (BACT).

BACT is acceptable when the emissions levels are very low or insignificant and the cost to remove these emissions is very high, therefore the CAT 398 NA is in compliance with BACT.

AQD, R336.1225

CAT 3406 NA engine is not subject to Rule 336.1225 if the associated stack is greater than 1.5 times the building height (MDNRE, Air Quality Division Variance, effective date 1/21/10). The stack at this site will be constructed at a height greater than 1.5 times the building height.

AQD, R336.1702

CAT 3406 NA engine is subject to Rule 336.1702 - Emissions are based on a determination of BACT. This engine meets BACT requirements based on insignificant emissions as described above.

Genset Engine Cummings GTA19

State Exemptions

The Cummings GTA19 NA compressor engine has a maximum heat input less than 10,000,000 BTU per hour, which qualifies it for exemption under Michigan Air Quality Division (AQD) Rule 336.1285(g). AQD R336.1278 however, requires a permit if actual emissions from any activity exceeds significant levels (40 tons/year NO_x or 40 tons/year CO). A permit to install is required for subject compressor engine, but is not subject to major source fees. The allowable emissions may be determined as necessary by dispersion modeling of the ambient impact, or as directed by AQD staff.

NSPS, Subpart JJJJ

Cummings GTA19 NA engine is not subject to NSPS Subpart JJJJ. Subject engine is less than 500 HP and was constructed before June 1, 2008. See rule 60.4230(a)(4)(iii).

NESHAP, Subpart ZZZZ

Cummings GTA19 NA engine was constructed July 26, 2006 and therefore subsequent to the June 12, 2006 mandate. This engine is subject to NESHAP Subpart ZZZZ, for HAP area sources and will be subject to emission limitations beginning immediately. (See Rule 63.6595). A catalytic converter will be installed on this engine to come into compliance with this rule.

AQD, R336.1224

Cummings GTA19 NA engine is subject to Rule 336.1224 (2)(c) - Best Available Control Technology for Toxics (T-BACT) is not warranted when in compliance with Best Available Control Technology (BACT). BACT is acceptable when the emissions levels are very low or insignificant and the cost to remove these emissions is very high, therefore the Cummings GTA19 NA is in compliance with BACT.

AQD, R336.1225

Cummings GTA19 NA engine is not subject to Rule 336.1225 if the associated stack is greater than 1.5 times the building height (MDNRE, Air Quality Division Variance, effective date 1/21/10). The stack at this site will be constructed at a height greater than 1.5 times the building height.

AQD, R336.1702

Cummings GTA19 NA engine is subject to Rule 336.1702 - Emissions are based on a determination of BACT. This engine meets BACT requirements based on insignificant emissions as described above.

Acid Rain Title IV

Cummings GTA19 NA engine/genset is not subject to this program. Electrical generation is specific to site use only and will not be sold offsite under any circumstances.

Dehydrator Burner

The Glycol reboiler burner has maximum heat inputs less than 50,000,000 BTU per hour, which qualifies it for exemption under Michigan Air Quality Division (AQD) Rule 336.1282(b)(i). A **permit to install is not required** for subject burner but is included in this permit application only to maintain an accurate site emission inventory.

Dehydrator Reboiler Vent

Rule 336.1288 (b)(ii) exempts dehydrators that only process natural gas from the Antrim zone. Grand Canyon facility will produce only Antrim gas. Additionally, the opacity rate of subject emissions is less than 5%. A **permit to install is not required** for reboiler vent but is included in this permit application only to maintain an accurate site emission inventory.

Line Heaters and Heater Treater Burners

The line heaters and heater treater burners have maximum heat inputs less than 50,000,000 BTU per hour, which qualifies them for exemption under Michigan Air Quality Division (AQD) Rule 336.1282(b)(i). A **permit to install is not required** for subject burners but is included in this permit application to maintain an accurate site emission inventory.

Fixed Roof Tanks

Rule 284. Except as specified in R 336.1278, the requirement of R 336.1201(1) to obtain a permit to install does not apply to containers, reservoirs, or tanks used exclusively for any of the following:

(e) Storage of sweet crude or sweet condensate in a vessel that has a capacity of less than 40,000 gallons.

The tanks at subject site contain a maximum of 16,800 gallons therefore exempt from permitting by rule.

Emergency Flare

R 336.1288 Permit to install exemptions; oil and gas processing equipment.

Rule 288. The requirement of R 336.1201(1) to obtain a permit to install does not apply to any of the following: (c) A sweet gas flare.

3.2 Title V Renewable Operating Permit Applicability

An emission inventory was compiled for the proposed facility, including sources exempt from the state permit system to determine whether a Title V Renewable Operating Permit (ROP) is required. **A Title V ROP is required** for this facility, based on uncontrolled PTE greater than major source levels. PTE of the criteria pollutants from the engines is greater than 100 tons per year for nitrogen oxides and less than 100 tons for the remaining criteria pollutants; there is no lead. Potential to emit hazardous air pollutants (HAPs) from the above listed equipment, and from all possible leaking equipment, is less than 10 tons per year of any individual HAP, and less than 25 tons per year of total HAPs.

In order to opt-out of the Title V, ROP program Savoy Energy is willing to restrict NOx emissions via State permit conditions to levels below the threshold. A catalytic converter was installed to the existing CAT 398 compressor engine and is listed under the current permit. A catalytic converter will also be installed on the proposed generator engine to help lower emissions to levels that will insure opt-out conditions and to also remain in compliance with subpart ZZZZ. (See Emission Tables)

4.0 CONTROL TECHNOLOGY ANALYSIS

4.1 Compressor Engine

4.1.1 CAT 398 NA Compressor Engine

The CAT 398 NA compressor engine emissions are controlled pursuant permit 121-11.

4.1.2 CAT 3406 NA Compressor Engine

The CAT 3406 NA Compressor Engine is uncontrolled.

4.2 Genset

The Cummings GTA19 generator engine will be controlled with a three-way catalytic converter. The catalyst is designed for industrial natural gas engine applications. The element is placed in an integral insertion tracks within the catalyst housing. The element is sealed around the perimeter with a layer of Fiberfrax (a non-asbestos gasket), Duroblanket material, an element cover, and a catalyst access cover plate. Each catalyst element is designed for durable industrial operation with low pressure drop, and resistant to vibration and shock inherent in the catalyst's metal support design.

The catalytic converter will reduce emissions as follow:

NOx: 90%
CO: 80%
VOC: 50%

4.3 Dehydrator Reboiler/Burner

Detailed information on the dehydrator reboiler and the dehydrator burner is not included within this permit. No emission control is required to meet BACT/T-BACT limits, due to low uncontrolled emission rates from both units.

4.4 Heater Treaters, Line Heaters and Flare

All associated burners are uncontrolled.

4.5 Crude Oil Storage Tanks

Vapors from all crude oil tanks are controlled by capturing and routing to the flare.

5.0 STACK PARAMETERS

Compressor Engine Stack CAT 398 NA

Height above ground level: 36 feet
Inside Diameter: 8 inches
Orientation: Vertical (Up)
Fuel Input: 7.85 mmbtu/hp-hr
Exhaust Flow Rate: 3144 cfm @ stack temperature
Exhaust Stack Temperature: 1132° F
Source Classification Code: 2-02-002-53
Material (Natural Gas) Throughput Code 08

Compressor Engine Stack CAT 3406 NA

Height above ground level: 36 feet
Inside Diameter: 8 inches
Orientation: Vertical (Up)
Fuel Input: 7.84 mmbtu/hp-hr
Exhaust Flow Rate: 1172 cfm @ stack temperature
Exhaust Stack Temperature: 1103° F
Source Classification Code: 2-02-002-53
Material (Natural Gas) Throughput Code 08

Generator Engine Stack Cummings GTA19

Height above ground level: 36 feet
Inside Diameter: 8 inches
Orientation: Vertical (Up)
Fuel Input: 3892 cf/hr
Exhaust Flow Rate: 3548 cfm @ stack temperature
Exhaust Stack Temperature: 1043° F
Source Classification Code: 2-02-002-53
Material (Natural Gas) Throughput Code 08

Dehydrator Burner Stack: 0.250 mmbtu/hr

Height above ground level: 36 feet
Inside Diameter: 6 inches
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired
Air/Gas Ratio: 10:1
Exhaust Temperature: 800° F

Dehydrator Reboiler Vent

Height above ground level: 16 feet
Inside Diameter: 2 inches
Orientation: Vertical
Exhaust Temperature: 150° F
Source Classification Code: 3-10-003-23
Material (Natural Gas) Throughput Code 05

Heater Treater Stack: (4 identical) 0.500 mm/btu/hr

Height above ground level: 20 feet
Inside Diameter: 14 inches
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired

Line Heater Stack: (4 identical) 0.500 mm/btu/hr

Height above ground level: 20 feet
Inside Diameter: 8 inches
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired

Emergency Flare

Height above ground level: 20 feet
Inside Diameter: 8 inches
Allowable Flow Rate: 1.6 mmcf/day
Orientation: Vertical
Burner Type: Atmospheric Mixture – Direct Fired

6.0 EMISSION CALCULATIONS

6.1 Calculations of Potential Emissions from the Natural Gas Engine

BASIS:

Potential emissions of Criteria pollutants were determined using emission factors provided by the Vendor.

6.1.1 CAT 398 NA Compressor Engine

Emission Factors:
9.4 (NOx) g/bhp-hr
9.9 (CO) g/bhp-hr
1.6 (HC) g/bhp-hr

Potential Emissions, tpy = (Brake Horse Power) x Emission Factor = (grams/hr)

Stack Concentration Calculation (CAT 398 NA)

Exhaust Flow Rate: 3,147 acfm
NOx: 12.42 lbs/hr (Uncontrolled)

$$\text{Stack Conc.:} = \text{Emission Rate, } \frac{12.42 \text{ lb}}{\text{hr}} \times \frac{\text{hr}}{60 \text{ min}} \times \frac{453.6 \times 10^6 \text{ ug}}{\text{lb}} \times \frac{\text{min}}{3,147 \text{ ft}^3} \times (3.281 \text{ ft/m})^3$$

6.1.2 CAT 3406 NA Compressor Engine

Emission Factors:
21.4 (NOx) g/bhp-hr
1.4 (CO) g/bhp-hr
1.4 (HC) g/bhp-hr

Potential Emissions, tpy = (Brake Horse Power) x Emission Factor = (grams/hr)

Stack Concentration Calculation (CAT 3406 NA)

Exhaust Flow Rate: 1172 acfm
NOx: 10.14 lbs/hr

$$\text{Stack Conc.:} = \text{Emission Rate, } \frac{10.14 \text{ lb}}{\text{hr}} \times \frac{\text{hr}}{60 \text{ min}} \times \frac{453.6 \times 10^6 \text{ ug}}{\text{lb}} \times \frac{\text{min}}{1172 \text{ ft}^3} \times (3.281 \text{ ft/m})^3$$

6.1.3 Cummings GTA19 Generator Engine

Emission Factors:
15.78 (NOx) g/bhp-hr
0.37 (CO) g/bhp-hr
2.35 (HC) g/bhp-hr

Potential Emissions, tpy = (Brake Horse Power) x Emission Factor = (grams/hr)

Stack Concentration Calculation (Cummings GTA19)

Exhaust Flow Rate: 3,548 acfm
NOx: 17.22 lbs/hr (Uncontrolled)

$$\text{Stack Conc.:} = \text{Emission Rate, } \frac{17.22 \text{ lb}}{\text{hr}} \times \frac{\text{hr}}{60 \text{ min}} \times \frac{453.6 \times 10^6 \text{ ug}}{\text{lb}} \times \frac{\text{min}}{3,548 \text{ ft}^3} \times (3.281 \text{ ft/m})^3$$

6.2 Calculation of Potential Emissions from Glycol Dehydrator Reboiler

BASIS:

- ♦ Potential emissions of Criteria pollutants and Hazardous Air Pollutants (HAPS) were determined using GLYCalc Version 4.0 software (Appendix D)

6.3 Calculation of Potential Emissions Dehydrator Burner, Line Heaters, Heater Treaters, & Emergency Flare

- ♦ **AP-42** Emission Factors in lb/10⁶/ft³

Emission Factors:	140.0	(NO _x)
	35.0	(CO)
	5.8	(VOC)

Dehydrator Burner

Fuel Gas volume (250,000 BTU/HR) / (1,000 btu/ft³) = 250 ft³/hr
(250 ft³/hr) / (1,000,000 ft³) x Factor = Emissions (lb/hr)

Line Heater & Heater Treater Burners

Fuel Gas volume (500,000 BTU/HR) / (1,000 btu/ft³) = 500 ft³/hr
(500 ft³/hr) / (1,000,000 ft³) x Factor = Emissions (lb/hr)

6.4 Fugitive Emissions

BASIS:

- ❖ Emission factors from USEPA document *New Equipment Leak Emission Factors for Oil and /Gas Production*.
- ❖ Gas composition analysis indicate no HAPS in subject source natural gas therefore calculations for fugitive HAP emissions have been omitted for this PTI.

TABLE 2.1

Natural Gas-Fired Engine Uncontrolled Emissions
Goetz 8 Trust CPF
Oil & Gas Production Facility

Equipment	Horse Power	Emission Factor (gm/bhp/hr)			Potential Emissions Tons/Year			
		CO	NOx	HC	CO	NOx	HC	Stack Conc.
CAT 398 NA	600	9.90	9.40	1.60	57.3	54.4	9.30	2.2 e6 NOx
Cat 3406 NA	215	1.40	21.4	1.40	2.91	44.4	2.91	
Cummings GTA19	495	0.37	15.78	2.35	1.77	75.4	11.23	

TABLE 2.2

Natural Gas-Fired Engine Controlled Emissions
Goetz 8 Trust CPF
Oil & Gas Production Facility

Equipment	Horse Power	Emission Factor (gm/bhp/hr)			Potential Emissions Tons/Year			
		CO	NOx	HC	CO	NOx	HC	
CAT 398 NA	600	9.90	9.40	1.60	11.48	5.44	4.64	
Cat 3406 NA	215	1.40	21.4	1.40	-	-	-	
Cummings GTA19	495	0.37	15.78	2.35	0.35	7.54	5.62	

TABLE 2.3

Dehydrator Burner Uncontrolled Emissions
Goetz 8 Trust CPF
Oil & Gas Production Facility

Equipment	Natural Gas	Emission Factor (lb/10 ⁶ /ft ³)			Potential Emissions Pounds/Yr		
Burner	Thruput (mmcf/yr)	CO	NOx	VOCs	CO	NOx	HCs
Dehydrator Burner	2.19	35	140	2.8	76.6	308	6.14
Totals					76.6	308	6.14

TABLE 2.4

Dehydrator Reboiler Vent Uncontrolled Emissions
Goetz 8 Trust CPF
Oil & Gas Production Facility

Equipment	GLYCalc Version 4.0 Report	Potential Emissions Tons/Yr
Dehydrator	THC Tons/yr	Benzene
Dehydrator Reboiler	13.35	0.0723

TABLE 2.5

Burner Emission Sources
Goetz 8 Trust CPF
Oil & Gas Production Facility

Equipment	Number of Burners	Potential Emissions LBS/YR	
		NOx (Each)	NOx (Total)
Line Heaters	4	616	2464
Heater Treaters	4	616	2464
Dehydrator Burner	1	308	308
Totals			5236

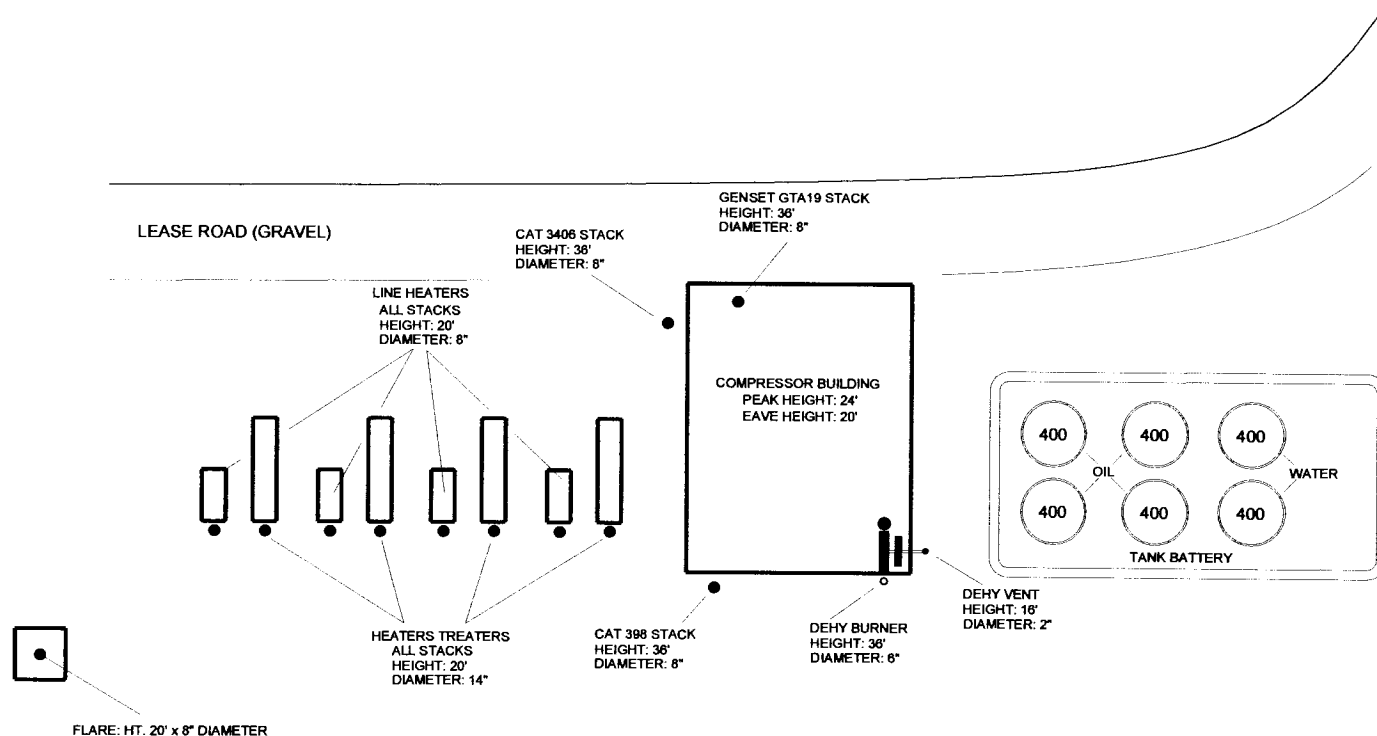
TABLE 2.6

Total All Emission Sources (Controlled and Uncontrolled)
Goetz 8 Trust CPF
Oil & Gas Production Facility

Equipment	Tons/Yr		
	CO	NOx	HC
CAT 398 (Controlled)	11.48	5.44	4.64
CAT 3406 (Uncontrolled)	2.91	44.40	2.91
Cummings GTA19 (Controlled)	0.35	7.54	5.62
Dehydrator Reboiler			13.35
Heater Treaters (4)		1.23	
Dehydrator Burner		0.154	
Line Heaters (4)		1.23	
Emergency Flare		0.016	
Oil Tanks B/Loss (4) (Controlled)			0.065
Oil Tanks W/Loss (4) (Controlled)			0.169
Valves/Connections			0.094
Truck Loadouts (2)			6.13
Total	14.74	60.01	32.978



NOT TO SCALE



SAVOY ENERGY
GOETZ TRUST 8 CPF
SEC. 8, T6S - R3E
LAT: 41° 58' 16.035"
LON: 84° 05' 40.200"
ADRIAN TOWNSHIP
LENAWEE COUNTY

FIGURE 1

SITE PLAN

ECT

ENVIRONMENTAL CONSULTANTS & TECHNOLOGY

DEPARTMENT:
ENVIRONMENTAL

TITLE: SITE PLAN

DATE: 10/31/11

PROJECT#/MGR
110820-0100/WMC

CLIENT:
SAVOY ENERGY

CAD OPERATOR
WMC

2655.59'

SCALE 1"=400'

LAT 41°58'16.035" N
LON 84°05'40.200" W

FIELD

WOODED

EXISTING DRIVE

FIELD

FIELD

FIELD

FIELD

Goetz 3-8A

FIELD

FIELD

FISK DRAIN

EXISTING DRIVE
FIELD

FIELD

PROPOSED WELL
GOETZ TRUST, 3-8
LAT 41°57'57.653" N
LON 84°05'59.791" W

FIELD

FIELD

FIELD

EAST & WEST 1/4 LINE SECTION 8, T.6S. R.3E.

2619.82

Goetz 2-8

EXISTING WELL
GOETZ TRUST, 1-8
LAT 41°57'48.657" N
LON 84°05'51.053" W

WOODED

Goetz 8 CPF

WOODED

APPROVED BY:

www.worthsurveying.com

Facility Name: Goetz Trust 8 CPF
Operator: Savoy Energy, LLP

G398 EMISSIONS DATA

G398 EMISSIONS DATA @ STANDARD RATINGS

ENGINE	RATING (hp/rpm)	NOx	CO (gram/hp-hr)	HC	%O2	A/FR vol/vol	Tstack deg F	EXH FLOW cfm	AIR FLOW kg/hr	BSFC Btu/hp-hr
NA HCR	500/1200 stand/catalyst	12.7	13.7	2.0	0.5	9.5	1100	2261	1437	7800
NA HCR	412/1000 stand catalyst	18.3 11.2	0.8 12.1	1.2 1.7	2.0 0.5	10.5 9.5	1090 1101	1895 1838	1225 1139	7480 7609
NA LCR	450/1200 stand/catalyst	11.4	11.5	0.8	0.5	9.5	1202	2435	1459	8803
NA LCR	375/1000 stand catalyst	15.1 11.3	0.8 11.8	0.8 0.8	2.0 0.5	10.4 9.5	1000 1032	1778 1720	1220 1145	8273 8582
TA LCR	625/1200 stand catalyst	20.6 9.8	0.8 10.7	0.8 0.8	2.0 0.5	10.5 9.5	1040 1112	3053 3043	2040 1929	8026 8387
TA LCR	550/1000 stand catalyst	19.0 9.7	0.8 9.7	0.9 0.9	2.0 0.5	10.4 9.5	1004 1056	2568 2445	1750 1607	8011 8052
TA LCR	700/1200 stand	18.3	0.8	1.1	2.0	—	1096	3107	1999	7936
TA HCR	700/1200 stand catalyst	15.2 9.4	1.1 9.9	0.9 1.0	2.0 0.5	10.5 9.5	1103 1132	3278 3144	2155 1968	7778 7850
TA LCR	810/1000 stand	16.8	0.9	1.2	2.0	—	984	2484	1723	7846
TA HCR	810/1000 stand catalyst	14.9 8.9	0.8 9.6	1.1 1.8	2.0 0.5	10.5 9.5	1064 1075	2775 3032	1825 1698	7587 7804
TA HCR 32C LOW EMIS	700/1200 stand	5.0	1.8	1.4	6.2	13.6	1010	4482	3100	7843
TA HCR 32C LOW EMIS	610/1000 stand	5.0	1.2	2.0	7.6	14.2	960	3841	2770	7529
TA HCR 54C LOW EMIS	625/1200 stand	5.0	1.5	1.3	8.0	13.8	982	4136	2890	7791
TA HCR 54C LOW EMIS	550/1000 stand	5.0	1.3	1.7	6.7	14.2	929	3210	2350	7563

Note: G398 TA HCR @ 700 hp (catalyst) factors used; however engine's rated hp is 600 hp.



Natural Gas Engines



GTA19

EMISSION DATA

Sheet #ES1752C

Model: GTA19
Type: 4 Stroke, In-line, 6 Cylinder
Aspiration: Turbocharged & Aftercooled
Compression Ratio: 10:1
Fuel: Natural Gas

Application: Generator Drive
Rating: 495 HP at 1800 RPM
Bore: 6.25 in. (159mm)
Stroke: 6.25 in. (159mm)
Displacement: 1150 cu. in. (19L)

Performance Data

	Standby	Prime
BHP @ 1800 RPM	495	445
Torque (ft-lbs)	1444	1298
Fuel Flow (SCFH)	3892	3690
Fuel Consumption (BTU/Hp-hr)	7116	7504
Intake Air Flow (SCFM)	1210	1149
Exhaust Mass Flow (lb/hr)	5544	5265
Exhaust Flow (ACFM)	3548	3370
Exhaust Temperature (°F)	1043	1068

Exhaust Emissions Data

THC	Total Hydrocarbons (gr/hp-hr)	2.35	1.98
NMHC	Non-Methane Hydrocarbons (gr/hp-hr)	0.49	0.42
NEHC	Non-Ethane Hydrocarbons (gr/hp-hr)	0.17	0.15
NOx	Oxides of Nitrogen (gr/hp-hr)	15.78	16.17
CO	Carbon Monoxide (gr/hp-hr)	0.37	0.60
CO2	Carbon Dioxide (%)	9.30	9.50
O2	Oxygen (%)	4.30	4.00

Test Conditions

Data was recorded during steady-state rated engine RPM (± 25) with full load ($\pm 2\%$) and standardized to the following conditions:

Fuel Specification: Dry processed pipe line quality natural gas.
Fuel Temperature: 60°F \pm 9° at Flow Transmitter
Fuel Pressure: 14.73 PSIA \pm 0.5 PSIA at Flow Transmitter
Intake Air Temp: 77°F \pm 9° at inlet
Barometric Pressure: 29.92 In. Hg \pm 1 In. Hg

All emissions data is a calculated average of engines tested under the conditions shown above. This data is subject to instrumentation, measurement, and engine-to-engine variability. Engine operation with excessive air intake or exhaust restrictions beyond published maximum limits, or with improper maintenance may result in elevated emission levels.

Specifications May Change Without Notice.

Engine Speed (rpm)	1800	Fuel	NAT GAS
Compression Ratio	10.3:1	LHV of Fuel (Btu/SCF)	920
Aftercooler Inlet Temperature (°F)	N/A	Fuel System	LPG IMPCO
Jacket Water Outlet Temperature (°F)	210		
Ignition System	MAG	Minimum Fuel Pressure (psig)	1.5
Exhaust Manifold	WATER COOLED	Methane Number at Conditions Shown	80
Combustion System Type	STANDARD	Rated Altitude (ft)	500
at 77°F Design Temperature			

Engine Rating Data

Engine Power (w/o fan)

% Load**100%****75%****50%**

bhp

215

161

108

Engine Data

Specific Fuel Consumption (BSFC) (1)

Btu/bhp-hr

7837

8384

9636

Air Flow (Wet, @77°F, 28.8 in Hg)

lb/hr

1340

1082

810

Air Mass Flow (Wet)

scfm

292

236

177

Compressor Out Pressure

N/A

N/A

N/A

N/A

Compressor Out Temperature

N/A

N/A

N/A

N/A

Inlet Manifold Pressure

in. Hg (abs)

26.8

23.2

18.4

Inlet Manifold Temperature (10)

°F

82

82

82

Timing (11)

°BTDC

25

25

25

Exhaust Stack Temperature

°F

1189

1143

1103

Exhaust Gas Flow (Wet, @ stack temperature, 29.7 in Hg)

CFM

1172

896

666

Exhaust Gas Mass Flow (Wet)

lb/hr

1424

1150

861

Engine Emissions Data

Nitrous Oxides (NOx as NO2) (9)

(Corr. 15% O2)

g/bhp-hr

21.4

21.7

21.4

ppm

1671

1575

1374

Carbon Monoxide (CO) (9)

(Corr. 15% O2)

g/bhp-hr

1.4

1.5

1.7

ppm

1132

927

775

Total Hydrocarbons (THC) (9)

(Corr. 15% O2)

g/bhp-hr

1.4

1.3

1.6

ppm

317

283

292

Non-Methane Hydrocarbons (NMHC) (9)

(Corr. 15% O2)

g/bhp-hr

0.21

0.20

0.23

ppm

48

42

44

Exhaust Oxygen (9)

%

2.0

2.0

1.9

Lambda

1.17

1.14

1.14

Engine Heat Balance Data

Input Energy LHV (1)

Btu/min

28083

22532

17265

Work Output

Btu/min

9118

6838

4559

Heat Rejection to Jacket (2) (6)

Btu/min

10674

9231

7943

Heat Rejection to Atmosphere (Radiated) (4)

Btu/min

1123

901

691

Heat Rejection to Lube Oil (5)

Btu/min

0

0

0

Total Heat Rejection to Exhaust (to 77°F) (2)

Btu/min

7299

5640

4061

Heat Rejection to Exhaust (LHV to 350°F) (2)

Btu/min

5577

4249

3018

Heat Rejection to Aftercooler (3) (7) (8)

N/A

N/A

N/A

N/A

TYPICAL ENGINE & COMPRESSOR CONFIGURATION

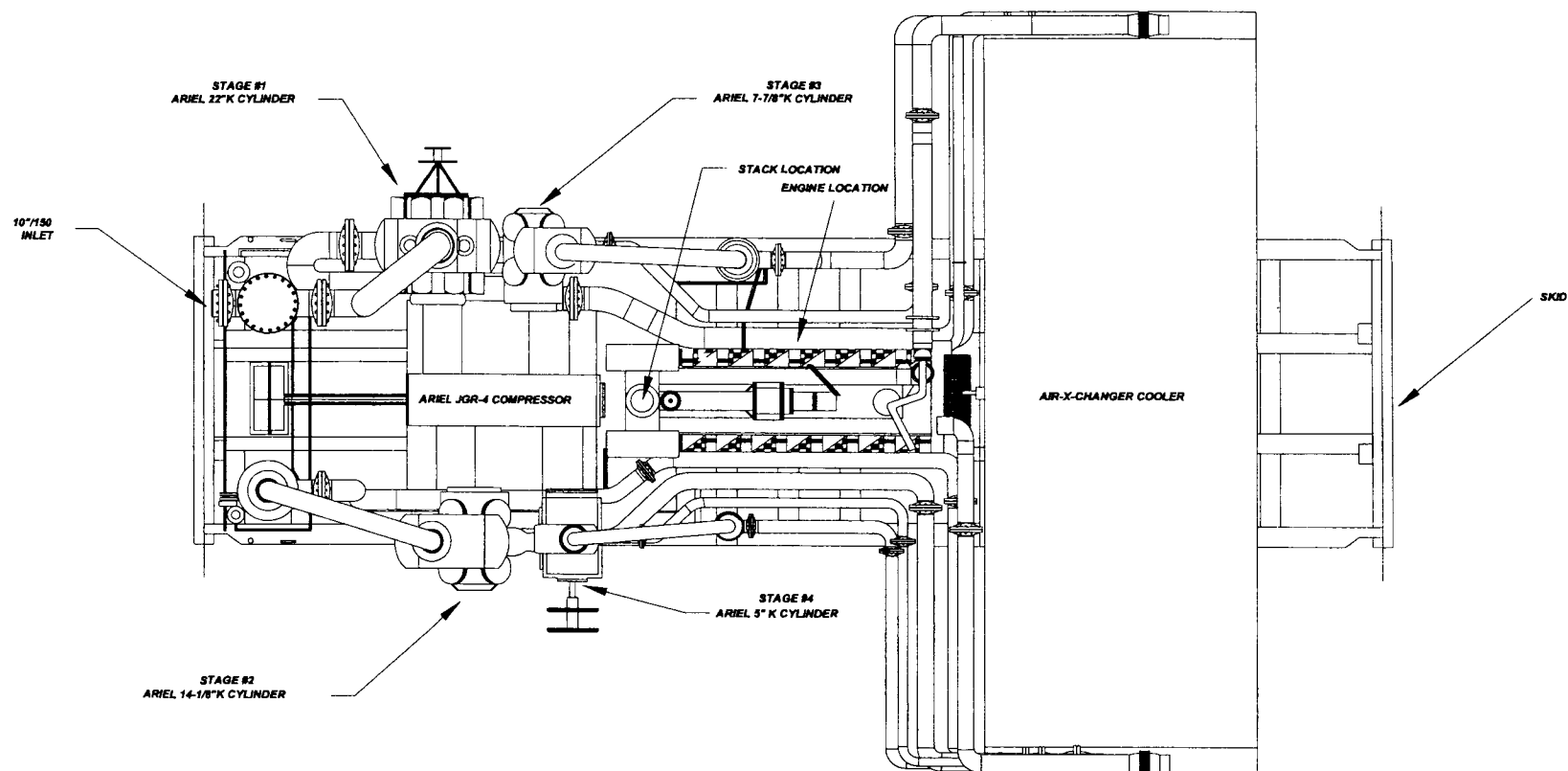


FIGURE 2

ENGINE/COMPRESSOR DRAWING

ECT ENVIRONMENTAL CONSULTING & TECHNOLOGY		
DEPT: ENVIRONMENTAL	TITLE: ENGINE/COMPRESSOR	DATE: 11/1/11
PROJECT #/MGR:	CLIENT: SAVOY ENERGY	CAD. OPER: WMC

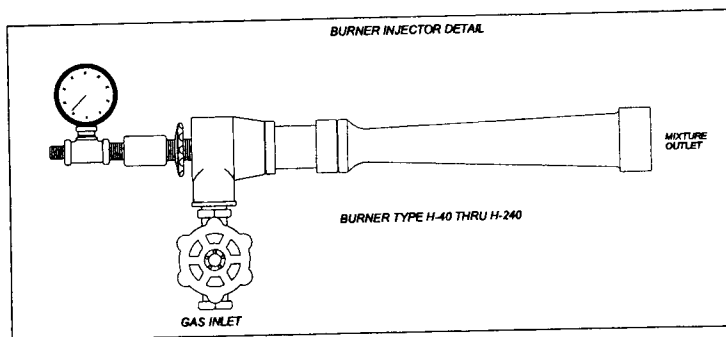
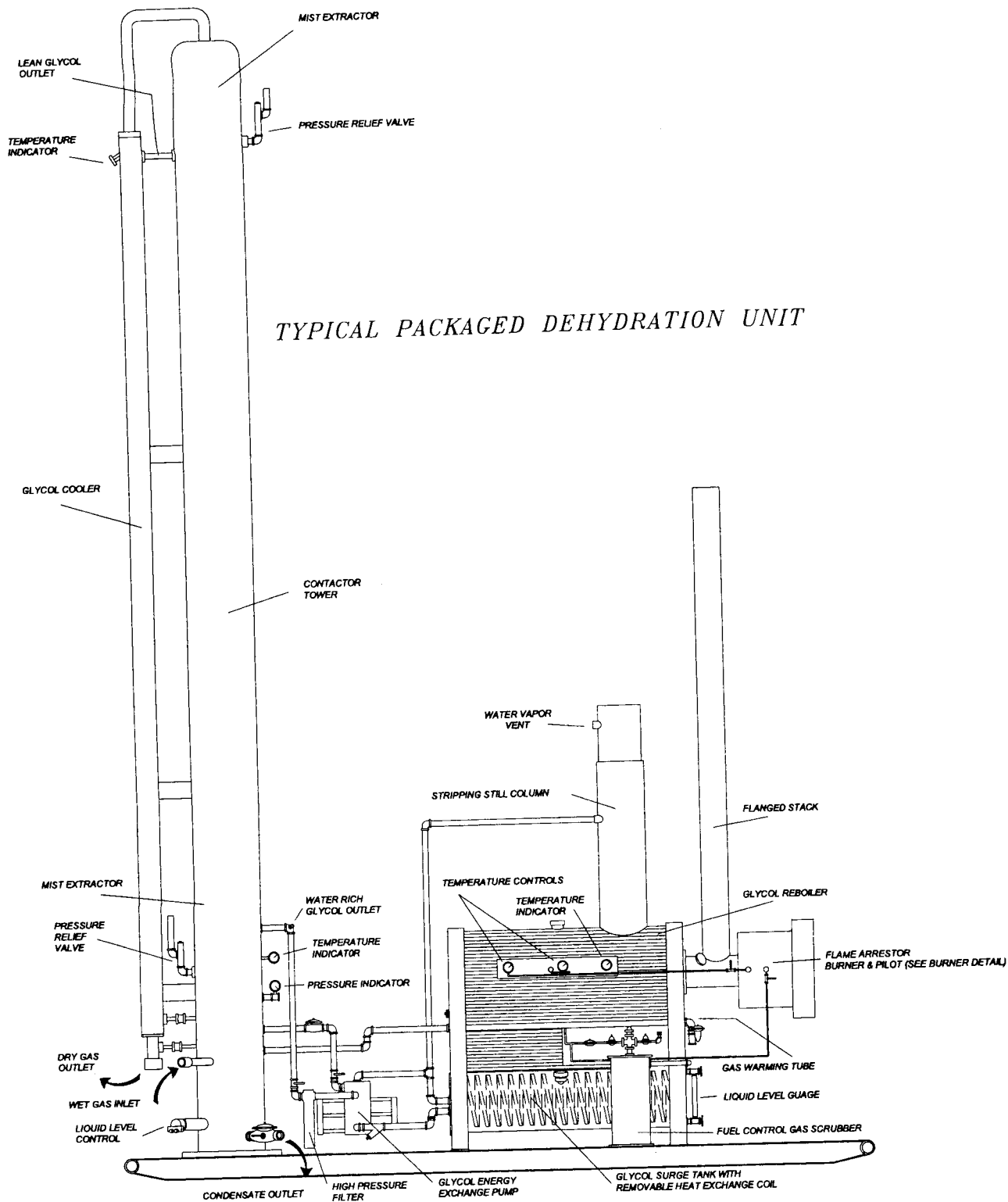


FIGURE 3

TYPICAL PACKAGED GLYCOL DEHYDRATION UNIT
AND BURNER DETAIL

D:\ACAD\FLS\DEHY\AMINE.DWG

ECT ENVIRONMENTAL CONSULTING & TECHNOLOGY		
DEPT.: ENVIRONMENTAL	TITLE: DEHYDRATOR DRAWING	DATE: 11/1/11
PROJECT MGR.: WMC	CLIENT: SAVOY ENERGY	CAD. OPER.: WMC



Emission Calculation Fact Sheet

Michigan Department Of Environmental Quality ♦ Environmental Science And Services Division ♦ (800) 662-9278

OIL AND GAS PRODUCTION FACILITIES

This document lists Source Classification Codes (SCC) and emission factors for various activities at oil and gas production facilities. They are provided as an aid in calculating emissions. These factors present one way to calculate emissions, **it is not required that facilities use these listed factors to quantify their emissions.** If a facility disagrees with any emission factor in this document, it may use other emission factors or methods of calculating emissions provided the emission factor or method correctly characterizes the processes at the facility and the resulting emissions. A facility doing so must provide documentation for the source of the emission factors or method used and justification for their use. For example, stack test data and manufacturer emission specifications provide more accurate emission estimates than the use of general emission factors.

Control factors

The listed emission factors are for uncontrolled emissions. If a facility has control equipment, such as a condenser, the emissions can be multiplied by the control factor.

Calculate the control factor by subtracting the percent control efficiency from 100 and then divide that number by 100. For example, if the control efficiency is 87%, the control factor would be $(100 - 87)/100 = 0.13$. Control efficiencies may be listed on the equipment or in the equipment documentation. Alternatively, equipment suppliers can provide control efficiency values.

Scientific notation

The emission factors are expressed in scientific notation, which means that the decimal point has been moved. If the exponent is negative, move the decimal point to the left. If the exponent is positive, move the decimal point to the right. If the exponent is zero, the decimal point does not move. For example, if a number is expressed as $2.0E-1$, move the decimal point one place to the left to get 0.20. If a number is expressed as $2.0E2$, move the decimal point 2 places to the right to get 200. If a number is expressed as $2.0E0$, the decimal point does not move. The number is 2.0.

NATURAL GAS FIRED ENGINES

Report all "standard" engine emissions together, and report all "lean burn" emission engines together. For facilities with both "standard" and "lean burn" emission engines, report "standard" engines and "lean burn" emission engines as separate emission units. Split the total fuel gas between the two different types of engines based on your best estimate of the relative amount of fuel burned in each type of engine at the facility.

You may group all natural gas combustion equipment with your standard "rich burn" or lean burn engines using the SCCs below. For example you may group all standard "rich burn" engines, natural gas process heaters, production compressors, and flares together under the SCC 2-02-002-53. Process heaters can also be reported separately using the appropriate SCC on page 2 of the fact sheet.

While the factors below are acceptable for MAERS reporting, it is highly recommended that emission factors from equipment vendor guarantees or from source specific testing (stack testing) be used.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS	CONTROL EFFICIENCY
2-02-002-53	Standard "rich burn" engines May include: <ul style="list-style-type: none">Natural gas process heatersNatural gas production, compressorsNatural gas production, flares-excluding SO₂	CO NOx PM10 PM2.5 SO ₂ VOC	3.794E3 LB/MMCF NATURAL GAS* 2.254E3 LB/MMCF NATURAL GAS* 9.69E0 LB/MMCF NATURAL GAS* 9.69E0 LB/MMCF NATURAL GAS* 6.00E-1 LB/MMCF NATURAL GAS* 3.02E1 LB/MMCF NATURAL GAS*	3-way Catalyst CO - 80%** NOX - 90%** VOC - 50%**
2-02-002-54	Lean burn engines May include: <ul style="list-style-type: none">Natural gas process heatersNatural gas production, compressorsNatural gas production, flares-excluding SO₂	CO NOx PM10 PM2.5 SO ₂ VOC	5.68E2 LB/MMCF NATURAL GAS* 4.162E3 LB/MMCF NATURAL GAS* 7.90E-2 LB/MMCF NATURAL GAS* 7.90E-2 LB/MMCF NATURAL GAS* 6.00E-1 LB/MMCF NATURAL GAS* 1.204E2 LB/MMCF NATURAL GAS*	Oxidation Catalyst CO - 80%** VOC - 50%**

* The emission factors listed are derived from AP-42 Chapter 3.2 (Tables 3.2-2 and 3.2-3).

** The control factors listed above can only be used if documentation is on file showing that the catalyst was inspected and maintained. If actual control efficiencies are different then those listed above, use the actual control efficiency.

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS	CONTROL EFFICIENCY
PROCESS HEATERS: include process heaters as a separate emission unit if they were not grouped with natural gas fired engines. The emission factors for process heaters come from the US EPA's Factor Information Retrieval (FIRE) data system, which can be accessed at http://cfpub.epa.gov/oarweb/index.cfm?action=fire.main . (Emission factors from Chapter 1.4 [Table 1.4-1] of US EPA's AP-42 Compilation of Air Pollutant Emission Factors may also be used to calculate emissions from process heaters.)				
3-10-004-04	Process Heater	CO NO _x PM ₁₀ SO _x VOC	3.50E1 LB/MMCF NATURAL GAS 1.40E2 LB/MMCF NATURAL GAS 3.00E0 LB/MMCF NATURAL GAS 6.00E-1 LB/MMCF NATURAL GAS 2.80E0 LB/MMCF NATURAL GAS	
TANK STORAGE: You may also use the US EPA TANKS 4.0 software to estimate emissions from tank storage. This software can be downloaded at www.epa.gov/ttn/chief/software/tanks/index.html .				
4-04-003-01	Fixed roof tank: breathing loss	VOC	3.6E1 LB/KGAL-YR CRUDE OIL (storage capacity)	Vapor recovery system - 95% Flare - 95%
4-04-003-02	Fixed roof tank: working loss <i>R. 336.1284(e) < 40,000 g</i>	VOC	1.1E0 LB/E3 GAL CRUDE OIL (throughput) <i>900/DA</i>	Vapor recovery system - 95% Flare - 95%
TRUCK LOADING				
4-06-001-32	Truck loading	VOC	2.0E0 LB/E3 GAL CRUDE OIL	Vapor recovery system - 95%
GAS DEHYDRATORS You may also use GRI-GLYCalc™ 4.0 software developed by the Gas Research Institute (GRI) to estimate emissions from glycol dehydrators. This software can be purchased at www.gastechnology.org .				
3-10-003-21	Glycol dehydrator – Niagaran	VOC	9.24E4 LB/YR-GPM GLYCOL*	Tube and shell condenser with flash tank - 90% Vapor recovery system - 95% Flare - 95%
3-10-003-22	Glycol dehydrator – Prairie du Chein	VOC	1.94E4 LB/YR-GPM GLYCOL*	Tube and shell condenser with flash tank - 90% Vapor recovery system - 95% Flare - 95%
3-10-003-23	Glycol dehydrator – Antrim	VOC	9.2E1 LB/YR-GPM GLYCOL*	Vapor recovery system - 95% Flare - 95%
* YR-GPM GLYCOL = gallon per minute glycol circulated, averaged over one year				
AMINE PLANT				
3-06-009-06	Amine plant	SO ₂	3.76E3 LB/TON HYDROGEN SUL	

SCC	DESCRIPTION	POLLUTANT	EMISSION FACTORS	CONTROL EFFICIENCY
FUGITIVE EMISSIONS: Facilities considered to be a "major source" under Title V of the Clean Air Act are required to calculate their regulated fugitive emissions (fugitive emissions from crude oil sumps do not have to be reported to MAERS).				
3-10-888-01	Fugitive emissions – Light crude production	VOC	1.44E1 LB/EACH-YR VALVE	
3-10-888-02	Fugitive emissions – Gas production	VOC	3.6E0 LB/EACH-YR VALVE	
3-10-888-03	Fugitive emissions – Gas plant	VOC	2.74E1 LB/EACH-YR VALVE	

SAMPLE CALCULATIONS

1. For a Glycol dehydrator (Niagaran) equipped with a vapor recovery system, where 0.3 GPM of glycol is circulated, the VOC emissions would be calculated as follows:

$$\text{VOC: } \underset{\text{Throughput}}{0.3 \text{ GPM}} \times \underset{\text{Emission Factor}}{9.24\text{E}4 \text{ LBS/YR-GPM}} \times \underset{\text{Conversion Factor}}{0.0005 \text{ LB/TON}} \times \underset{\text{Control Factor}}{(100 - 95)/100} = 0.69 \text{ TON VOC}$$

2. For standard "rich burn" engines with a properly maintained 3-way catalyst where 4.25 MMCF of fuel gas was burned, the CO emissions would be calculated as follows:

$$\text{CO: } 4.25 \text{ MMCF} \times 3,794 \text{ LB CO/MMCF} \times 0.0005 \text{ LB/TON} \times (100 - 80)/100 = 1.61 \text{ TON CO}$$

3. For lean burn engines where 4.25 MMCF of fuel gas was burned, the CO emissions would be calculated as follows:

$$\text{CO: } 4.25 \text{ MMCF} \times 568 \text{ LB CO/MMCF} \times 0.0005 \text{ LB/TON} = 1.21 \text{ TON CO}$$

Case Name: Savoy Energy Goetz Trust 8 CPF

File Name: C:\Program Files\GRI-GLYCalc4\Goetz Trust CPF Dehy at high glycol recirc.ddf

Date: July 25, 2011

DESCRIPTION:

Description: Predict dehy emissions for proposed sales gas.

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

CONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.0362	24.869	4.5386
Ethane	0.9641	23.137	4.2226
Propane	1.1532	27.677	5.0510
Isobutane	0.2127	5.105	0.9317
n-Butane	0.7321	17.571	3.2067
Isopentane	0.1254	3.010	0.5493
n-Pentane	0.2473	5.935	1.0831
n-Hexane	0.0749	1.798	0.3281
Cyclohexane	0.0611	1.468	0.2678
Other Hexanes	0.0479	1.149	0.2097
Heptanes	0.0783	1.878	0.3428
Methylcyclohexane	0.0162	0.389	0.0710
Benzene	0.0276	0.663	0.1211
Toluene	0.0236	0.566	0.1032
Xylenes	0.0251	0.602	0.1099
C8+ Heavies	0.0079	0.189	0.0345
Total Emissions	4.8335	116.005	21.1709
Total Hydrocarbon Emissions	4.8335	116.005	21.1709
Total VOC Emissions	2.8333	67.999	12.4098
Total HAP Emissions	0.1512	3.629	0.6623
Total BTEX Emissions	0.0763	1.831	0.3342

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	1.0363	24.870	4.5388
Ethane	0.9642	23.140	4.2231
Propane	1.1536	27.687	5.0529
Isobutane	0.2129	5.109	0.9323
n-Butane	0.7328	17.587	3.2096
Isopentane	0.1257	3.016	0.5504
n-Pentane	0.2479	5.950	1.0859
n-Hexane	0.0754	1.809	0.3302
Cyclohexane	0.0618	1.482	0.2705
Other Hexanes	0.0481	1.155	0.2108
Heptanes	0.0798	1.914	0.3494
Methylcyclohexane	0.0165	0.396	0.0723

Methylcyclohexane	0.0103	0.246	0.0449
Benzene	0.0181	0.435	0.0795
Toluene	0.0158	0.379	0.0692
Xylenes	0.0181	0.435	0.0794

C8+ Heavies	0.0307	0.737	0.1346
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Total Emissions	3.0797	73.912	13.4890
Total Hydrocarbon Emissions	3.0797	73.912	13.4890
Total VOC Emissions	1.8268	43.843	8.0013
Total HAP Emissions	0.0995	2.387	0.4357
Total BTEX Emissions	0.0521	1.250	0.2281

EQUIPMENT REPORTS:

CONDENSER

Condenser Outlet Temperature: 100.00 deg. F
 Condenser Pressure: 15.70 psia
 Condenser Duty: 1.04e-002 MM BTU/hr
 Hydrocarbon Recovery: 0.00 bbls/day
 Produced Water: 0.47 bbls/day
 VOC Control Efficiency: 1.73 %
 HAP Control Efficiency: 2.79 %
 BTEX Control Efficiency: 4.73 %
 Dissolved Hydrocarbons in Water: 87.25 mg/L

Component	Emitted	Condensed
Water	1.71%	98.29%
Carbon Dioxide	99.83%	0.17%
Nitrogen	100.00%	0.00%
Methane	99.99%	0.01%
Ethane	99.98%	0.02%
Propane	99.96%	0.04%
Isobutane	99.93%	0.07%
n-Butane	99.91%	0.09%
Isopentane	99.81%	0.19%
n-Pentane	99.74%	0.26%
n-Hexane	99.35%	0.65%
Cyclohexane	99.01%	0.99%
Other Hexanes	99.49%	0.51%
Heptanes	98.14%	1.86%
Methylcyclohexane	98.16%	1.84%
Benzene	98.41%	1.59%
Toluene	96.46%	3.54%
Xylenes	91.07%	8.93%
C8+ Heavies	16.05%	83.95%

ABSORBER

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages: 1.25
 Calculated Dry Gas Dew Point: 4.66 lbs. H2O/MMSCF

Temperature: 110.0 deg. F
 Pressure: 1200.0 psig
 Dry Gas Flow Rate: 2.5000 MMSCF/day
 Glycol Losses with Dry Gas: 0.2095 lb/hr
 Wet Gas Water Content: Saturated
 Calculated Wet Gas Water Content: 71.07 lbs. H₂O/MMSCF
 Calculated Lean Glycol Recirc. Ratio: 3.73 gal/lb H₂O

Component	Remaining in Dry Gas	Absorbed in Glycol
Water	6.55%	93.45%
Carbon Dioxide	99.74%	0.26%
Nitrogen	99.97%	0.03%
Methane	99.98%	0.02%
Ethane	99.94%	0.06%
Propane	99.93%	0.07%
Isobutane	99.92%	0.08%
n-Butane	99.89%	0.11%
Isopentane	99.91%	0.09%
n-Pentane	99.89%	0.11%
n-Hexane	99.85%	0.15%
Cyclohexane	99.32%	0.68%
Other Hexanes	99.88%	0.12%
Heptanes	99.78%	0.22%
Methylcyclohexane	99.37%	0.63%
Benzene	93.96%	6.04%
Toluene	93.06%	6.94%
Xylenes	89.63%	10.37%
C8+ Heavies	99.62%	0.38%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	34.38%	65.62%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%
Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	0.50%	99.50%
n-Pentane	0.50%	99.50%
n-Hexane	0.50%	99.50%
Cyclohexane	3.20%	96.80%
Other Hexanes	1.00%	99.00%
Heptanes	0.50%	99.50%
Methylcyclohexane	4.00%	96.00%
Benzene	5.00%	95.00%
Toluene	7.91%	92.09%
Xylenes	12.96%	87.04%
C8+ Heavies	12.05%	87.95%

WET GAS STREAM

Temperature: 110.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 1.04e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.50e-001	7.42e+000
Carbon Dioxide	9.79e-002	1.18e+001
Nitrogen	8.84e+000	6.81e+002
Methane	6.43e+001	2.84e+003
Ethane	1.29e+001	1.06e+003
Propane	8.43e+000	1.02e+003
Isobutane	1.01e+000	1.62e+002
n-Butane	2.76e+000	4.42e+002
Isopentane	4.43e-001	8.80e+001
n-Pentane	7.01e-001	1.39e+002
n-Hexane	1.36e-001	3.21e+001
Cyclohexane	2.43e-002	5.62e+000
Other Hexanes	1.08e-001	2.56e+001
Heptanes	8.11e-002	2.23e+001
Methylcyclohexane	5.99e-003	1.62e+000
Benzene	1.40e-003	3.00e-001
Toluene	8.99e-004	2.28e-001
Xylenes	5.99e-004	1.75e-001
C8+ Heavies	1.72e-002	8.05e+000
Total Components	100.00	6.55e+003

DRY GAS STREAM

Temperature: 110.00 deg. F
Pressure: 1214.70 psia
Flow Rate: 1.04e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.82e-003	4.86e-001
Carbon Dioxide	9.78e-002	1.18e+001
Nitrogen	8.85e+000	6.81e+002
Methane	6.44e+001	2.84e+003
Ethane	1.29e+001	1.06e+003
Propane	8.44e+000	1.02e+003
Isobutane	1.01e+000	1.62e+002
n-Butane	2.76e+000	4.41e+002
Isopentane	4.44e-001	8.79e+001
n-Pentane	7.01e-001	1.39e+002
n-Hexane	1.36e-001	3.21e+001
Cyclohexane	2.41e-002	5.58e+000
Other Hexanes	1.08e-001	2.55e+001
Heptanes	8.10e-002	2.23e+001
Methylcyclohexane	5.96e-003	1.61e+000
Benzene	1.32e-003	2.82e-001
Toluene	8.38e-004	2.12e-001
Xylenes	5.38e-004	1.57e-001

C8+ Heavies 1.71e-002 8.02e+000

Total Components 100.00 6.54e+003

LEAN GLYCOL STREAM

Temperature: 110.00 deg. F

Flow Rate: 4.30e-001 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	2.38e+002
Water	1.50e+000	3.63e+000
Carbon Dioxide	1.25e-012	3.03e-012
Nitrogen	7.95e-012	1.93e-011
Methane	9.03e-018	2.19e-017
Ethane	1.17e-007	2.84e-007
Propane	1.23e-008	2.98e-008
Isobutane	1.67e-009	4.04e-009
n-Butane	4.76e-009	1.15e-008
Isopentane	1.65e-004	3.99e-004
n-Pentane	3.25e-004	7.87e-004
n-Hexane	9.84e-005	2.38e-004
Cyclohexane	5.25e-004	1.27e-003
Other Hexanes	1.26e-004	3.06e-004
Heptanes	1.03e-004	2.50e-004
Methylcyclohexane	1.77e-004	4.28e-004
Benzene	3.95e-004	9.55e-004
Toluene	5.60e-004	1.36e-003
Xylenes	1.12e-003	2.70e-003
C8+ Heavies	1.74e-003	4.21e-003
Total Components	100.00	2.42e+002

RICH GLYCOL STREAM

Temperature: 110.00 deg. F

Pressure: 1214.70 psia

Flow Rate: 4.51e-001 gpm

NOTE: Stream has more than one phase.

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.45e+001	2.38e+002
Water	4.19e+000	1.06e+001
Carbon Dioxide	1.20e-002	3.03e-002
Nitrogen	7.62e-002	1.92e-001
Methane	2.58e-001	6.51e-001
Ethane	2.39e-001	6.02e-001
Propane	2.91e-001	7.33e-001
Isobutane	5.34e-002	1.35e-001
n-Butane	1.84e-001	4.64e-001
Isopentane	3.16e-002	7.97e-002
n-Pentane	6.24e-002	1.57e-001
n-Hexane	1.89e-002	4.76e-002
Cyclohexane	1.57e-002	3.97e-002
Other Hexanes	1.21e-002	3.06e-002
Heptanes	1.99e-002	5.01e-002
Methylcyclohexane	4.24e-003	1.07e-002

Benzene	7.57e-003	1.91e-002
Toluene	6.80e-003	1.72e-002
Xylenes	8.26e-003	2.08e-002
C8+ Heavies	1.38e-002	3.49e-002

Total Components	100.00	2.52e+002
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REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F
 Pressure: 14.70 psia
 Flow Rate: 1.84e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	7.92e+001	6.93e+000
Carbon Dioxide	1.42e-001	3.03e-002
Nitrogen	1.41e+000	1.92e-001
Methane	8.35e+000	6.51e-001
Ethane	4.12e+000	6.02e-001
Propane	3.42e+000	7.33e-001
Isobutane	4.77e-001	1.35e-001
n-Butane	1.64e+000	4.64e-001
Isopentane	2.26e-001	7.93e-002
n-Pentane	4.46e-001	1.57e-001
n-Hexane	1.13e-001	4.74e-002
Cyclohexane	9.40e-002	3.85e-002
Other Hexanes	7.22e-002	3.03e-002
Heptanes	1.02e-001	4.98e-002
Methylcyclohexane	2.15e-002	1.03e-002
Benzene	4.78e-002	1.81e-002
Toluene	3.53e-002	1.58e-002
Xylenes	3.51e-002	1.81e-002
C8+ Heavies	3.71e-002	3.07e-002
Total Components	100.00	1.02e+001

CONDENSER VENT GAS STREAM

Temperature: 100.00 deg. F
 Pressure: 15.70 psia
 Flow Rate: 4.08e+001 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	6.12e+000	1.18e-001
Carbon Dioxide	6.40e-001	3.03e-002
Nitrogen	6.39e+000	1.92e-001
Methane	3.78e+001	6.51e-001
Ethane	1.86e+001	6.02e-001
Propane	1.55e+001	7.33e-001
Isobutane	2.16e+000	1.35e-001
n-Butane	7.43e+000	4.64e-001
Isopentane	1.02e+000	7.92e-002
n-Pentane	2.01e+000	1.56e-001
n-Hexane	5.09e-001	4.71e-002
Cyclohexane	4.21e-001	3.81e-002
Other Hexanes	3.25e-001	3.01e-002
Heptanes	4.55e-001	4.89e-002
Methylcyclohexane	9.55e-002	1.01e-002

Benzene	2.13e-001	1.79e-002
Toluene	1.54e-001	1.52e-002
Xylenes	1.45e-001	1.65e-002
C8+ Heavies	2.70e-002	4.93e-003

Total Components	100.00	3.39e+000
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CONDENSER PRODUCED WATER STREAM

Temperature: 100.00 deg. F
Flow Rate: 1.36e-002 gpm

Component	Conc. (wt%)	Loading (lb/hr)	(ppm)
Water	1.00e+002	6.81e+000	999904.
Carbon Dioxide	7.45e-004	5.08e-005	7.
Nitrogen	1.08e-004	7.34e-006	1.
Methane	7.37e-004	5.02e-005	7.
Ethane	8.21e-004	5.60e-005	8.
Propane	8.67e-004	5.91e-005	9.
Isobutane	8.89e-005	6.06e-006	1.
n-Butane	4.16e-004	2.83e-005	4.
Isopentane	5.15e-005	3.51e-006	1.
n-Pentane	1.11e-004	7.56e-006	1.
n-Hexane	2.89e-005	1.97e-006	0.
Cyclohexane	1.41e-004	9.63e-006	1.
Other Hexanes	1.46e-005	9.97e-007	0.
Heptanes	1.71e-005	1.16e-006	0.
Methylcyclohexane	1.81e-005	1.24e-006	0.
Benzene	2.08e-003	1.42e-004	21.
Toluene	1.51e-003	1.03e-004	15.
Xylenes	1.82e-003	1.24e-004	18.
C8+ Heavies	9.61e-007	6.55e-008	0.
Total Components	100.00	6.81e+000	1000000.

CONDENSER RECOVERED OIL STREAM

Temperature: 100.00 deg. F
Flow Rate: 7.32e-005 gpm

Component	Conc. (wt%)	Loading (lb/hr)
Water	1.94e-002	6.04e-006
Carbon Dioxide	2.29e-003	7.13e-007
Nitrogen	1.53e-003	4.76e-007
Methane	2.17e-002	6.77e-006
Ethane	1.23e-001	3.83e-005
Propane	7.30e-001	2.27e-004
Isobutane	2.71e-001	8.44e-005
n-Butane	1.29e+000	4.00e-004
Isopentane	4.84e-001	1.51e-004
n-Pentane	1.28e+000	3.99e-004
n-Hexane	9.81e-001	3.05e-004
Cyclohexane	1.20e+000	3.72e-004
Other Hexanes	4.91e-001	1.53e-004
Heptanes	2.97e+000	9.24e-004
Methylcyclohexane	6.04e-001	1.88e-004

Benzene	4.69e-001	1.46e-004
Toluene	1.46e+000	4.56e-004
Xylenes	4.80e+000	1.49e-003
C8+ Heavies	8.28e+001	2.58e-002

Total Components	100.00	3.11e-002
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CONDENSER CONTROL CURVE DATA REPORT:
-----CONDENSER CONTROL EFFICIENCY CURVES

Note: Condenser curves computed for the range 40.0 F <= T <= 170.0 F. DO NOT
EXTRAPOLATE BEYOND THIS RANGE!

Temp(F)	BTEX	Total HAP	VOC
40.0	49.25	32.89	6.86
45.0	43.13	27.84	5.74
50.0	36.62	22.93	4.75
55.0	30.08	18.38	3.94
60.0	24.61	14.81	3.37
65.0	19.93	11.87	2.95
70.0	16.06	9.50	2.64
75.0	12.94	7.63	2.40
80.0	10.46	6.15	2.21
85.0	8.50	5.00	2.06
90.0	6.94	4.08	1.93
95.0	5.70	3.35	1.82
100.0	4.70	2.76	1.72
105.0	3.87	2.28	1.63
110.0	3.19	1.88	1.53
115.0	2.61	1.54	1.42
120.0	2.11	1.24	1.30
125.0	1.67	0.98	1.15
130.0	1.27	0.75	0.96
135.0	0.93	0.54	0.73
140.0	0.56	0.32	0.38
145.0	0.27	0.14	0.01
150.0	0.24	0.13	0.01
155.0	0.21	0.11	0.01
160.0	0.18	0.10	0.01
165.0	0.16	0.08	0.01
170.0	0.13	0.07	0.01



JENNIFER M. GRANHOLM
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



STEVEN E. CHESTER
DIRECTOR

Variance
Suspension of Enforcement of Rule 225
For
Certain Natural Gas Combustion Emissions

1. Variance Statement

In accordance with the provisions of Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Act 451), a variance is granted for a period of one year from the effective date of this document, suspending the requirements of Rule 225, promulgated pursuant to Act 451 (R 336.1225 *Health-based screening level requirement for new or modified sources of air toxics*) for each emission unit that combusts natural gas as fuel and meets either of the following criteria:

1. Fuel-burning equipment or natural gas fired equipment, with a maximum natural gas usage rate of 50,000 cubic feet per hour or less, where the emissions from the natural gas combustion are discharged unobstructed vertically upwards from an emissions discharge point at least 1.5 times the height of the building most influential in determining the predicted ambient impacts of the emissions.

2. Air pollution control equipment, as defined by Act 451, not limited in the natural gas usage rate.

This variance is limited to the emissions from the combustion of natural gas only. The requirements of Rule 225 are not suspended for any emissions from the emission unit not resulting from the combustion of natural gas.

The source types that may qualify for this variance include, but are not limited to, natural gas fired boilers, internal combustion engines, and regenerative thermal oxidizers. This variance does not obviate the need for persons to apply for and obtain air use permits to install as required by Rule 201 (R 336.1201 *Permits to install*) unless otherwise exempt. However, while this variance is in effect, persons applying for a permit under Rule 201 for an emission unit(s) that meets either of the above-listed criteria will not need to demonstrate compliance with Rule 225 for emissions related to combustion of natural gas.

Permits issued while this variance is in effect will remain valid and in full force irrespective of the effective dates of this variance.

2. Regulatory Background

Part 55 of Act 451, along with rules promulgated pursuant to Act 451, regulates emissions of air pollutants to the ambient air.

Section 5535 (MCL 324.5535 *Suspension of enforcement; reasons; variance*) of Act 451 allows the Department to suspend enforcement of any rule that would be an unreasonable hardship upon the person, provided it is granted by variance and it does not violate the federal Clean Air Act (CAA).

Section 5536 (MCL 324.5536 *Variance; considerations effecting*) specifies considerations the Department shall give due recognition to in granting any variance, and conditions and requirements that shall apply.

Section 5538 (MCL 324.5538 *Variance; period granted; report; conditions*) specifies that any variance granted pursuant to Section 5535 shall be for a period of time specified by the Department at the time of granting but not to exceed one year. However, any variance may be continued from year to year.

Rule 225 (*Health-based screening level requirement for new or modified sources of air toxics*) requires that the person responsible for the new or modified source of air toxics comply with the health-based screening levels established by the Department.

3. Justification for the Department's Position

The Department has received and evaluated permit applications for natural gas combustion processes. Under Rule 225, some of these processes would not meet the requirements of the rule for one or more air toxic contaminants (acrolein being one) based upon the most recent technical data and information available to the applicant and the Department.

Requiring compliance with Rule 225 for the natural gas combustion portion of the sources qualifying for this variance would create an undue hardship and would be out of proportion to the benefits to be obtained by compliance. Natural gas is recognized as an environmentally beneficial, clean burning fuel. There is no better readily available alternative fuel for some sources at this time.

This variance will not cause violations of the CAA. While many of the sources that qualify for this variance are also regulated under the CAA, this variance does not exempt these sources from obtaining a permit under Rule 201 and complying with all aspects of the CAA.

Good engineering practice will be applied to sources that qualify for the variance to assure a continuing level of public health protection. Specifically, emissions from sources other than air pollution control equipment (e.g., regenerative thermal oxidizer) must be discharged unobstructed vertically upwards and stack heights must be at least 1.5 times the height of the most influential building to provide adequate dispersion of the emissions.

The Department believes further study is needed as to the toxic air contaminant emissions from the combustion of natural gas, in particular the toxics information for acrolein, and other possible alternatives to address this issue and to protect public health and the environment.

Final Approval

The Chief of the Air Quality Division, having had opportunity to review the variance and having been delegated authority to grant variances by the Director of the Michigan Department of Environmental Quality pursuant to the provisions of Part 55 of Act 451 and otherwise being fully advised on the premises,

Hereby grants the variance, which shall be entered in the record of the Department.


G. Vinson Hellwig, Chief
Air Quality Division
Michigan Department of Environmental Quality

Effective Date: January 20, 2006

Continuation of Variance

The Chief of the Air Quality Division, having had opportunity to review the above variance effective on January 20, 2006, and having been delegated authority to grant and continue variances by the Director of the Michigan Department of Natural Resources and Environment pursuant to the provisions of Part 55 of Act 451 and otherwise being fully advised of the premises,

hereby continues the variance for a period of one year, which shall be entered in the record of the Department.



G. Vinson Heltwig, Chief
Air Quality Division
Michigan Department of Natural Resources and Environment

Effective Date: January 21, 2010